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ECOWAS's Infrastructure

A Regional Perspective

Rupa Ranganathan
Vivien Foster

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Abstract

Infrastructure improvements boosted growth in the Economic Community of West African States (ECOWAS) by one percentage point per capita per year during 1995–2005, primarily thanks to growth in information and communication technology. Deficient power infrastructure held growth back by 0.1 percent. Raising the region's infrastructure to the level of Mauritius could boost growth by 5 percentage points.

Overall, infrastructure in the 15 ECOWAS countries ranks consistently behind southern Africa across many indicators. However, there is parity in access to household services—water, sanitation, and power.

ECOWAS has a well-developed regional road network, though sea corridors and ports need attention. Surface transport is expensive and slow, owing to cartelization, restrictive regulations, and delays. There is no regional rail network. Air transport has improved despite the lack of a strong hub-and-spoke structure. Safety remains a concern. Electrical power, the most expensive and least reliable in Africa, reaches 50 percent of the population but meets just 30 percent of demand. Regional power trading would bring substantial benefits if Guinea could become a hydropower exporter. Prices for critical ICT services are relatively high. Recent panregional initiatives have improved roaming. New projects are underway to provide access and improved services to unconnected countries.

Completing and maintaining ECOWAS's infrastructure will require sustained spending of $1.5 billion annually for a decade, with one-third going to power. Although the necessary spending is only 1 percent of regional GDP, some countries' share is between 5 and 25 percent of national GDP. Clearly, external assistance will be needed.

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ECOWAS's Infrastructure: A Regional Perspective

Rupa Ranganathan and Vivien Foster

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This paper draws on contributions from sector specialists from the Africa Infrastructure Country Diagnostic Team; notably, Heinrich Bofinger on air transport, Michael Minges on information and communication technologies, and Alvaro Federico Barra on spatial analysis.

The paper is based on data collected by local consultants and benefited greatly from feedback provided by colleagues in the relevant World Bank teams; notably Yusupha Crookes (director of the Africa Regional Integration Department), Andrew Roberts (Africa Regional Integration Department), Gael Raballand (transport), and Charles Kunaka (International Trade Department). The paper benefited from feedback provided by REC staff at a May 2010 Workshop organized by the Infrastructure Consortium for Africa in Tunis and at other meetings.

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Synopsis

Sound infrastructure is a critical determinant of growth in West Africa. Over the period 1995–2005, infrastructure improvements have boosted West Africa's growth by one percentage point per capita per year. This positive growth effect has come almost entirely from the ICT revolution, while deficient power infrastructure has held economic growth back by 0.1 percentage point per capita per year. If West Africa's infrastructure could be improved to the level of the strongest performing country in Africa (Mauritius), regional growth performance would be boosted by some 5 percentage points.

Infrastructure in the 15 countries of the Economic Community of West African States (ECOWAS) ranks consistently behind Southern Africa across a range of infrastructure indicators. However, in some areas such as access to household services—water, sanitation, and power—the differences between ECOWAS and the leading region, SADC, are not significant. On the other hand, the gaps with respect to electricity generation capacity, as well as road and telephone density, are much more substantial.

The difficult economic geography of the ECOWAS region makes it particularly important to take a regional approach to infrastructure development. ECOWAS is characterized by small-scale economies, many of which are physically cut off from key resources. Eight member states have populations of less than 10 million people, and 11 ECOWAS member states have a gross domestic product (GDP) of less than $5 billion. The small size of these economies prevents the capture of scale economies in infrastructure development, making it difficult for governments to afford the high fixed costs associated with infrastructure development. Three of the ECOWAS member states are landlocked and rely on the infrastructure of neighbors for access to critical markets. The region is also characterized by a number of international rivers; perhaps most notably the Niger, the catchment of which spans seven member countries. Regional approaches are critical to developing transport and hydraulic infrastructure that are essentially regional public goods.

ECOWAS has a relatively well developed regional road network based on seven main arteries, but coastal countries are not devoting enough attention to sea corridors. Five of these regional road arteries are sea corridors for the three landlocked countries; they provide each of these countries with more than one route to the sea. In addition, there are two corridors—one coastal, one Sahelian—that are important for intraregional trade. These key road corridors have already been almost entirely paved, and the greater part of them are in good or fair condition. Interestingly, the main quality problems found on these regional networks arise on the up-country portions of sea corridors located in the coastal countries. Essentially, these portions of road are of limited importance to the national economy, hence maintenance may be neglected even though they are absolutely critical to the landlocked country in the hinterland. Ironically, these are typically the most heavily used portions of the regional network, and yet they are in the worst condition. The other weak point in ECOWAS's regional road network is the coastal corridor between Abidjan and Dakar. where conflict in a number of countries has led to extensive deterioration of the coastal route.

Surface transport in West Africa is very expensive compared with the rest of Africa and the developing world. The causes are cartelization and restrictive regulation of the trucking industry. In West

Africa, road transport tariffs are on the order of $0.08 per tonne-kilometer, compared with $0.05 per tonne-kilometer in southern Africa and well below $0.04 per tonne-kilometer in much of the rest of the developing world. High freight charges do not reflect high transport costs so much as high trucking profits that can be traced to the lack of competition in the industry. In addition, the *tour de rôle* regulatory framework is based on market sharing and centralized allocation of freight, which limits vehicle mileage and undermines incentives for investing to improve service quality.

Surface transport in West Africa is also very slow compared with the rest of Africa and the developing world, because of frequent delays associated with administrative processes. The average effective velocity of road freight movements in West Africa is around 6 miles per hour, or about half the effective velocity of 11 miles per hour found in southern Africa. In both cases, however, freight is moving no faster than a horse and buggy. This slow speed has little to do with road infrastructure—which is generally of reasonable quality—and much to do with administrative barriers such as border and customs clearance, as well as formal and informal checkpoints and road blocks that keep trucks stationary for extended periods of time.

The overall times and cost of moving goods along West Africa's key trade routes is time-consuming and expensive—requiring on the order of 400–1,000 hours of time and costing between $175 and $310 per tonne. Port delays and administrative charges account for the lion's share of the time. The high costs reflect the high transport costs in the region and the inefficiency of many ports. Random checkpoints, bribery, and police inspections add more to the time and cost of moving freight.

There is no real regional rail network in the ECOWAS area. Existing lines are lightly used, and the presence of three different rail gauges complicates integration. The national rail networks of ECOWAS's member states are mostly independent from each other, with the exception of two relatively successful binational rail corridors. This situation is in contrast to Southern Africa, where interconnected national railway systems form a regional railway network that spans half a dozen countries. Further integration of West Africa's rail systems is technically complicated by the presence of three different gauges across the region. Given the poor performance and relatively light use of existing rail networks, the economic case for integration is also far from clear. The more pressing priority is to improve the performance of national systems to allow them to compete more effectively with road transport.

In the ports sector, West Africa lacks a clear maritime hub as the center for a more effective transshipment network and needs to improve performance across the board. The performance of West African ports does not compare favorably with ports elsewhere in Africa and is well behind global best practice. Services can easily cost twice global benchmarks, while productivity is around half the global mark; delays can be several times as long. At present, West Africa lacks a clear regional hub for transshipment. Prior to the conflict in Côte d'Ivoire, Abidjan had begun to play this role, but at present major shipping lines serve West Africa via North Africa or even southern Spain. The creation of a West African hub would facilitate the consolidation of sea freight for the region.

On air transport, ECOWAS has made great strides on market liberalization, but safety remains a concern, and the region lacks a strong hub-and-spoke structure. West Africa is more advanced than most regions in the implementation of the Yamassoukro Decision. Market liberalization has substantially altered regional air traffic patterns (and fueled a huge expansion of domestic air transport in Nigeria).

Entrance of new carriers has helped to reverse the market collapse that followed the demise of major flag carriers, particularly in the countries of the Banjul Accord Group, though not so much in the West African Economic Monetary Union. However, liberalization also seems to have contributed to a decline in air traffic safety. Numerous countries in the region need to strengthen their civil aviation authorities, and it may be that a regional approach would help to pool scarce human resources and enhance regulatory independence. As in the sea ports sector, there is a marked absence of a strong regional hub for air transport, particularly compared with eastern and southern Africa, where strong hubs have evolved—notably Addis Ababa, Johannesburg, and Nairobi.

Power supply in the ECOWAS region is the most expensive and least reliable in Africa. With 50 percent of its population electrified, West Africa is ahead of other regions on power access. Yet generation capacity is very limited, and power supply is highly unreliable, with 30 percent of existing power demand unmet and widespread outages. Moreover, average historic costs of power in the region have been high—on the order of $0.20 per kilowatt-hour. With power demand likely to triple over the next decade, expanding power supply infrastructure is critical to the region's economic future.

West Africa already practices regional power trade. Further pursuit of such trade could bring substantial benefits, but much depends on Guinea's ability to become a hydropower exporter. The principle of regional power exchange is already well-established thanks to the efforts of the West Africa Power Pool, even if the actual volumes of power traded remain small. In the future, there is the potential to develop trade much further, to the point that many countries in the region could be better off by importing more than half of their power needs. Doing so would bring numerous advantages. The region's cost of energy would be reduced by $435 million annually (or around 3 percent). Most countries would save significantly on their national power development costs and a number of smaller countries could substantially reduce their long-run marginal cost of power. In addition, regional trade would allow a shift to cleaner energy that would reduce regional carbon emissions by 5 million tonnes annually. Overall, the returns on investments in regional interconnection yield an average rate of return of 33 percent. However, most of these benefits hinge on the development of 3,700 megawatts of cost-effective hydropower in Guinea, where a host of technical, financial, and political challenges make this a difficult prospect.

Compared with other regional economic communities in Africa, ECOWAS performs relatively well on access to information and communication technologies (ICTs) but faces relatively high prices for critical services. Thanks to the emergence of a number of pan-regional operators, as well as intensive collaboration among telecommunications regulators, the region is very advanced with respect to regional roaming arrangements. Despite the presence of submarine cables along the coast, however, many countries remain unconnected, and many of those with access fail to benefit fully owing to monopoly control of the international gateway. A number of new projects are underway, with plans for several unserved countries to connect to the new cables. Creating competition between landing stations will be critical to providing affordable service. In order for the benefits of submarine access to spread within the region, it will be important to complete the 1,900 missing kilometers of terrestrial fiber optic network. Associated investments are small and anticipated returns from reducing the price of broadband access relatively high, with payback periods of less than a year.

Completing and preserving ECOWAS's regional ICT, power and transport backbones would require sustained spending of $1.5 billion annually over the course of a decade. This is about 10 percent of the

overall infrastructure spending requirements (regional and national) for the ECOWAS region as a whole. Of the total $1.5 billion, around a billion a year is associated with investment in the creation of new regional infrastructure assets, while the balance of $0.5 billion is needed to maintain the regional network in perpetuity once established, most of it associated with road maintenance. By far the largest item in the regional spending requirement is the power sector, with specifically regional power assets demanding $1 billion per year over the next decade. The transport sector comes in second place with an annual spending requirement of $0.4 billion.

The amounts that would have to be spent to meet regional requirements across all infrastructure sectors represent only 1 percent of regional GDP, but for some small countries the burden is insurmountable. The total regional spending requirement of $1.5 billion represents less than 1 percent of the regional GDP of $176 billion. In absolute terms, by far the largest burden falls on Guinea, which would have to spend $0.9 billion a year over the next decade to deliver the infrastructure assets (chiefly power) needed by the region. Nigeria comes in a distant second, with a spending requirement of $0.2 billion a year (also largely associated with power). If one looks at regional spending requirements relative to the size of each country's economy, the burden appears even more uneven. Guinea's regional spending requirement, in particular, translates to more than 25 percent of GDP, manifestly beyond what the national economy could plausibly deliver without external assistance. Another group of countries—The Gambia, Guinea-Bissau, Liberia—would need to spend around 5 percent of their GDP on regional spending requirements—a huge stretch, even if the absolute sums involved (no more than $20–30 million a year) do not look so large.

1 Introduction

The Africa Infrastructure Country Diagnostic (AICD) has conducted extensive data collection and analysis of infrastructure in Africa, including the 15 countries of the Economic Community of West African States (ECOWAS). The results have been presented in a variety of continental reports covering different areas of infrastructure—information and communication technology (ICT), irrigation, power, transport, and water and sanitation—and different policy areas—including investment needs, fiscal costs, and sector performance.

The purpose of this regional report is to present the key AICD findings for the ECOWAS community. The main value in doing so is that it makes it possible to benchmark the infrastructure situation in the region against that of other African peers, to identify the main gaps in the regional infrastructure backbones, and to quantify the costs and benefits of regional integration, as well as their distribution across member states.

A number of methodological issues should be borne in mind.

First, owing to the cross-country nature of the data collection, there is inevitably a time lag in the data. The period covered by AICD runs from 2001 to 2006. Most of the technical data presented are for 2006 (or the most recent year available), while financial data are typically averaged over the available period to smooth out the effect of short-term fluctuations. Given the fast pace of regional integration, the snapshot presented here does not necessarily correspond to today's situation but rather represents the 2006 baseline against which subsequent progress can be measured.

Second, given the need to make comparisons across countries, indicators and analysis had to be standardized and made consistent. That means that some of the indicators may be slightly different from those routinely reported and discussed at the country level.

Third, the database on which the analysis is based was designed to give a national and continental picture of infrastructure, as opposed to an explicitly regional picture. But national infrastructure provides the basic building blocks for regional integration, and hence can be used to build up a picture of the regional situation. Nevertheless, some specifically regional issues—particularly of the regulatory and institutional variety—may not have been explicitly addressed in the national data collection effort.

Fourth, while water resource management is an important aspect of regional integration in Africa, this report does not explore water resource issues. The reason is that the AICD project did not cover water resources per se, but rather the specific water resource needs associated with the power, irrigation, and water supply sectors.

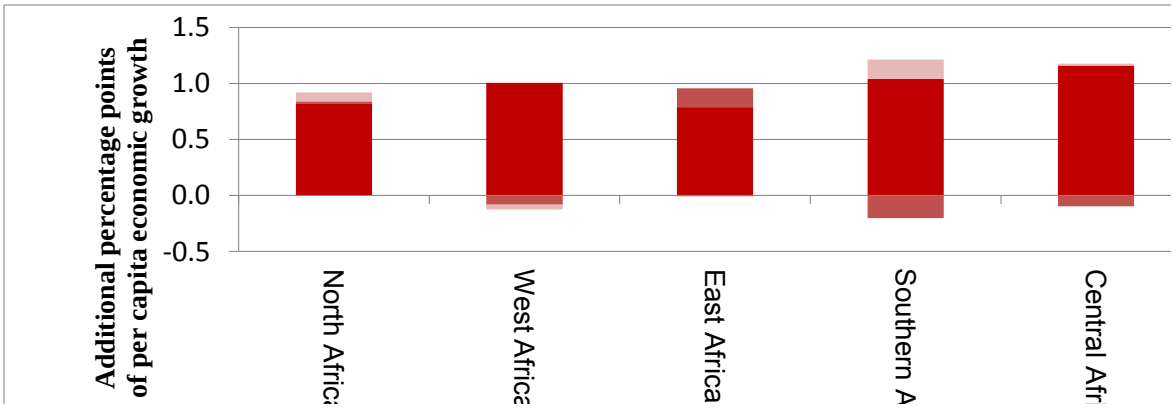
Why infrastructure matters

ICT infrastructure has made a significant contribution to growth performance in ECOWAS. The regional group has 15 member states: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. For the period

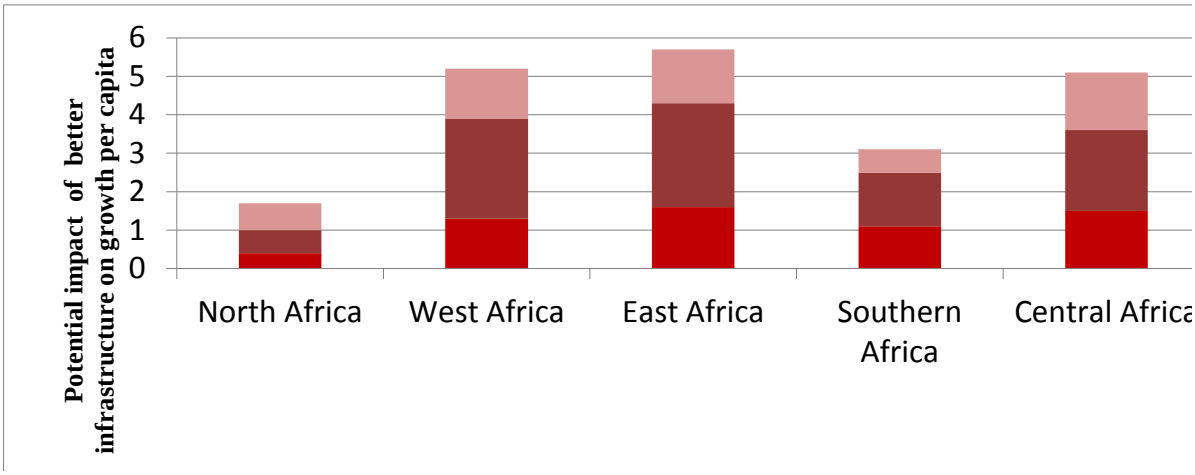
2003–08, all countries of the group experienced economic growth, although the averages varied by country. Overall, ECOWAS countries grew at a rate of 5 percent during the period, and infrastructure contributed one percentage point to that growth. As in other regions of Africa, most of that growth can be traced to the introduction of mobile telephony (figure 1.1a). At the same time, deficient power infrastructure held back economic growth in West Africa by 0.1 percentage point per capita per year.

Figure1.1a Infrastructure's contribution to economic growth, 1995–2005

a. Infrastructure's historic contribution to growth, 1995–2005



b. Infrastructure's potential contribution (% GDP per capita per year)



Source: Calderon 2008.

However, infrastructure could potentially contribute much more to economic growth than it has in the past (figure 1.1b). Simulations suggest that if West Africa's infrastructure could be upgraded to the level of the best-performing country in Africa (Mauritius), the impact on per capita economic growth would be on the order of 5 percent. While all areas of infrastructure—ICT, power, water, and transport—need to be upgraded, improvements in power could affect growth by more than 2.5 percent.

Why regional integration matters

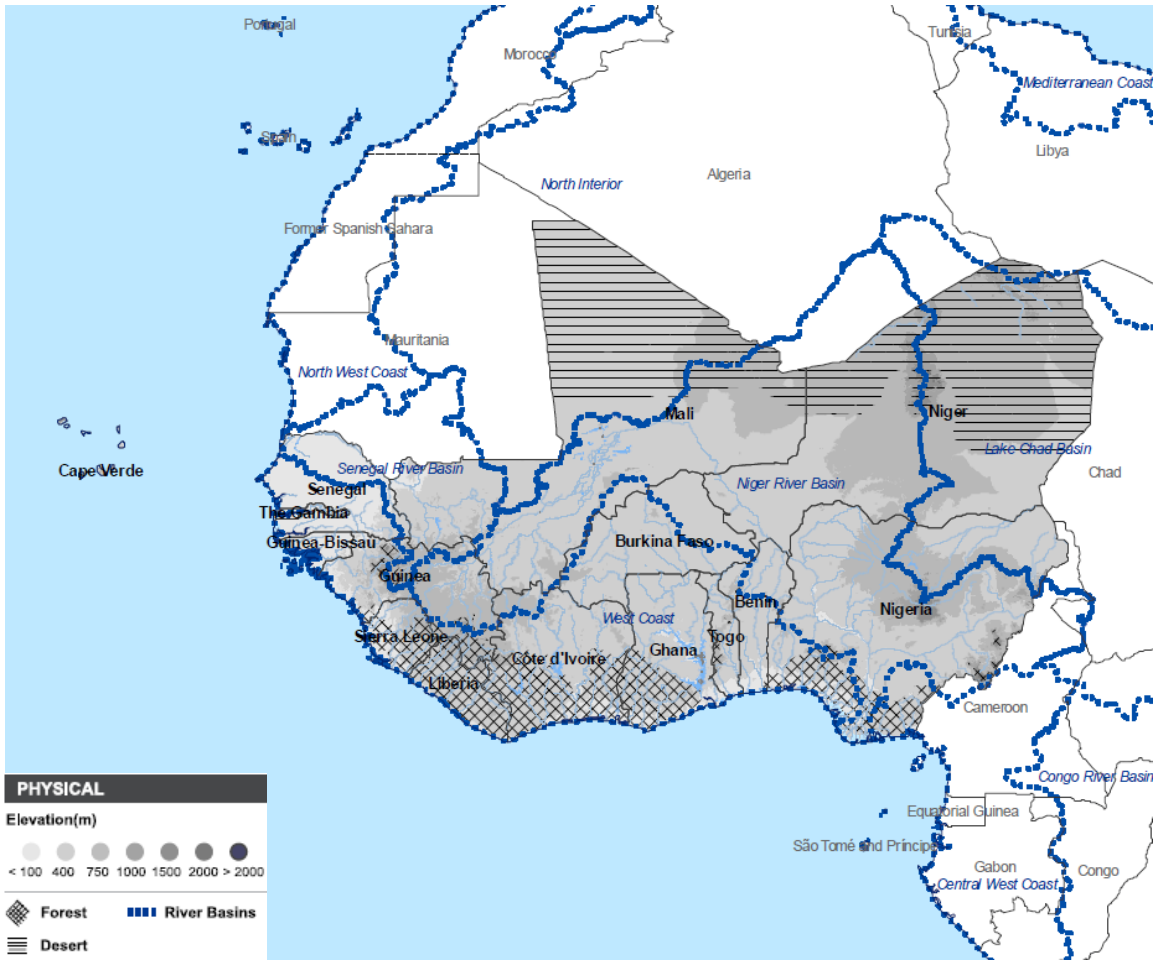
With its large number of small, isolated economies, ECOWAS's economic geography is particularly challenging. Of the 15 member countries, three are landlocked, 8 have fewer than 10 million people, 11 have a gross domestic product (GDP) of less than $5 billion per year, and 6 rely on transnational river

basins for their water resources (figure 1.2a). In addition, 4 countries have recently emerged from conflict that has severely damaged their national infrastructure networks. Economic activity in the region is most intense in certain urban pockets along the coast, as well as in northern and central Nigeria, where GDP exceeds $1 billion per hundred square kilometers. Economic density tails off steadily as one moves inland and north, reaching a low point of less than $10 million per 100 square kilometers in the Sahel region (figure 1.2b).

Regional integration is likely the only way to overcome these handicaps and to allow ECOWAS member states to participate in the global economy. Integrating physical infrastructure is both a precursor to and enabler of deeper economic integration, thereby allowing countries to gain scale economies and harness regional public goods. Infrastructure sharing addresses problems of small scale and adverse location. Joint provision increases the scale of infrastructure construction, operation, and maintenance. Economies of scale are particularly important in the power and ICT sectors. Big hydropower projects that would not be economically viable for a single country make sense when neighbors share their benefits. Connecting countries through the undersea cable or satellite communications requires large up-front investments that require a regional approach.

As well as assessing the current state of regional infrastructure, this report identifies the basic infrastructure needed to provide minimum interconnection of transport, power and ICT grids. This level of interconnection would ensure: smooth land corridor transportation between landlocked countries and ports, as well as between major cities for internal trade; rational development of power supply options harnessing cost-effective generation technologies at efficient scale in the context of a regional trading pool; and fiber optic access to submarine cables through a robust communications network inter-linking capital cities. The missing physical links that currently hold back this degree of integration will be identified throughout the report, and detailed cost estimates presented in the final section.

Figure 1.2a Topographical profile of the ECOWAS region



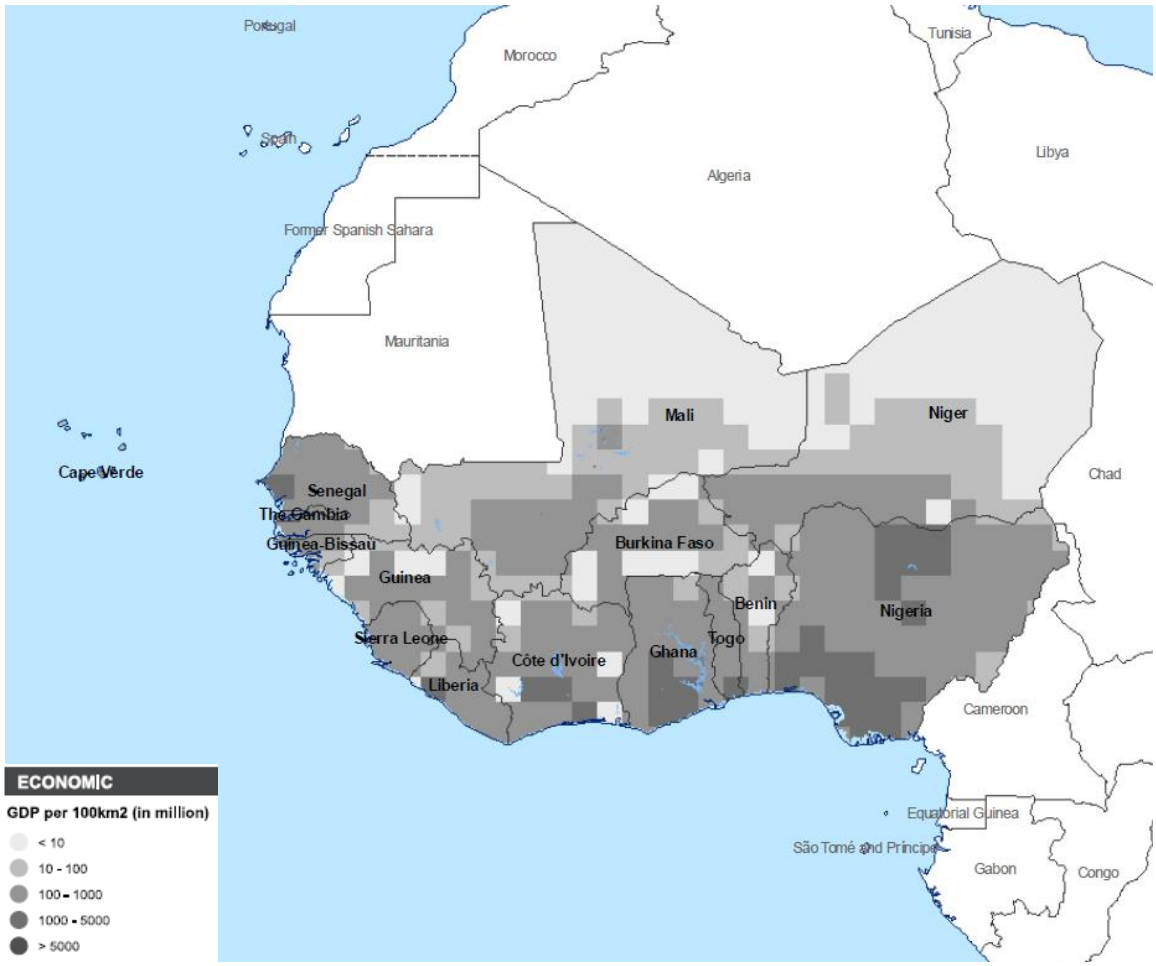
Source: AICD.

The state of ECOWAS's infrastructure

ECOWAS's infrastructure ranks consistently behind the Southern Africa Development Community (SADC) on all aggregate infrastructure indicators (table 1.1). However, in some areas such as access to improved sources of water and sanitation, as well as electricity, the differences between ECOWAS and the SADC—the Sub-Saharan leader—are not significant. On the other hand, the gaps with respect to electricity generation capacity, road density, and telephone density are much more substantial. The aggregates for ECOWAS as a whole inevitably mask substantial country variations within the region.

The following sections of the report review the main achievements and challenges with respect to the regional integration process for each of the main network infrastructures, as well as the benefits that regional integration promises in each case. Table 1.2 summarizes the main findings of this sectoral review. The final section of the paper presents the overall financial costs of implementing the regional integration agenda and assesses the affordability of this venture for the region.

Figure 1.2b Spatial distribution of economic activity within ECOWAS



Source: AICD.

Table 1.1 Benchmarking ECOWAS with other economic communities

	ECOWAS	EAC	SADC	Central
Paved road density	**38**	29	92	4
Mainline density	**28**	6	80	13
Mobile density	**72**	46	133	84
Internet density	**2**	2	4	1
Generation capacity	**31**	16	176	47
Electricity coverage	**18**	6	24	21
Improved water	**63**	71	68	53
Improved sanitation	**35**	42	46	28

Source: AICD.

Table 1.2 Progress and challenges for regional integration in ECOWAS

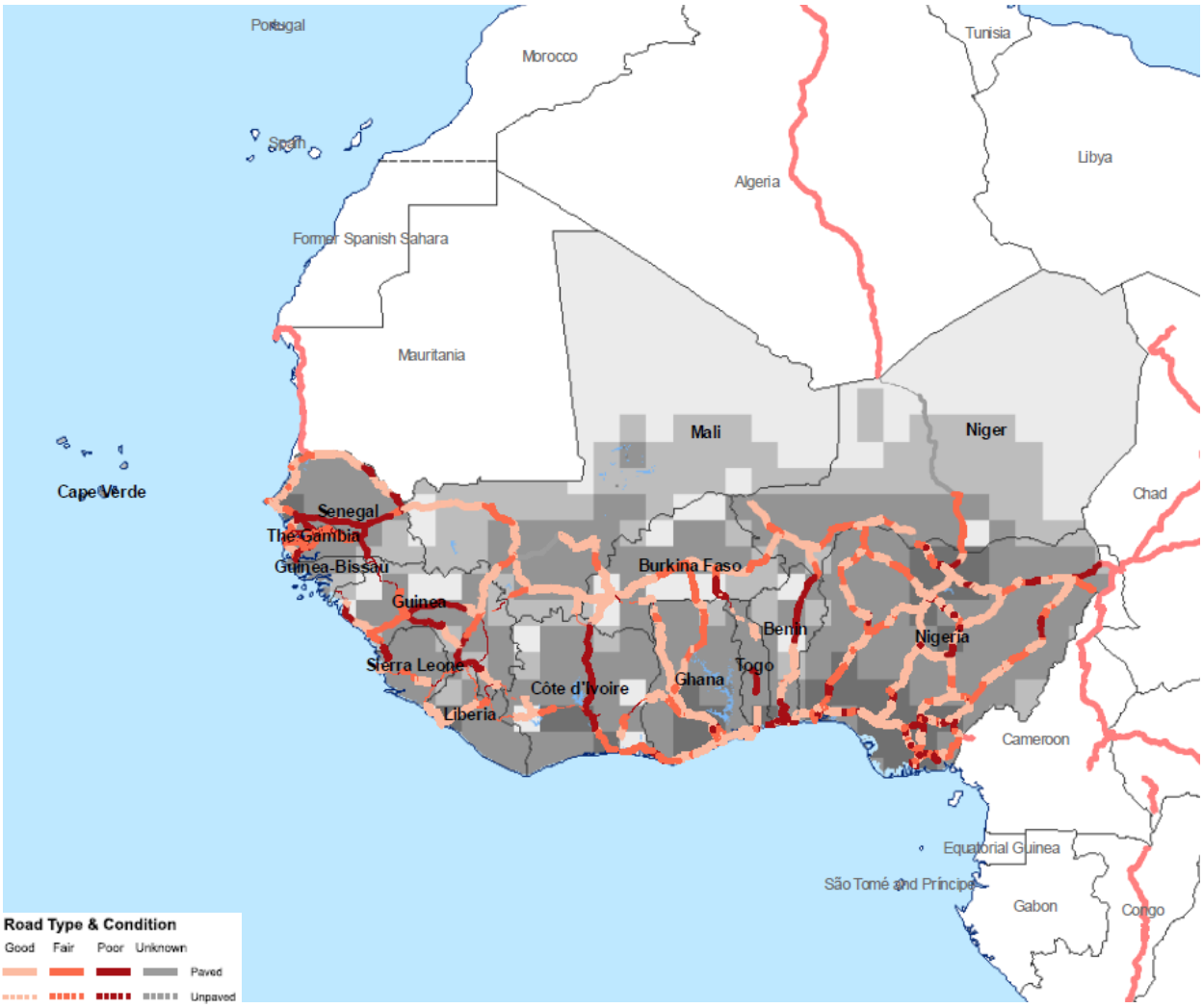
Sector	Achievements	Challenges	Promise of regional integration
Road transport	Several major international gateways in West Africa that facilitate trade.	High trucking charges and lengthy delays due to trade facilitation issues. Coastal countries appear to neglect maintenance of regional corridors.	Reducing costs and delays associated with surface transport of goods in the region.
Railways	Two relatively successful binational concessions	Low levels of passenger and freight traffic, poor operational performance of railways. Railways facing stiff competition from other modes of transport. Incompatible rail gauges.	
Ports	Burgeoning container and general cargo traffic.	Poor operational performance and absence of a transshipment hub.	
Air transport	Reasonable levels of interregional connectivity. WAEMU and BAG are most liberalized markets in Africa.	Low levels of connectivity within ECOWAS. Lack of a strong regional hub. Aging fleet and poor record with respect to air traffic safety.	Collaborating on improvement of safety record. Improving efficiency of regional air transport through better hub system.
Power	High electrification rates. Cost recovery is better than in other regions. Principle of regional trade already well established.	Lack of generation capacity leads to unreliable service, with only 70 percent of demand being satisfied. Utilities highly inefficient with regard to distribution losses and revenue collection.	Deepening regional integration would save the WAPP area $435 million in annual energy costs, and annual savings in carbon emissions of some five million tonnes of carbon. Long-run marginal cost of power in the WAPP would fall by $0.01 per kilowatt-hour or 5 percent. Overall rate of return on regional integration investments is 33 percent.
ICT	Access to ICT services among highest in Africa. Significantly cheaper to call on landline within ECOWAS than outside the region. Roaming arrangements relatively advanced. Associated regional telecom regulators have been active in promoting harmonization. Well-endowed with submarine cable infrastructure.	Relatively high prices for ICT services. Many countries not connected to the submarine cable. Even those connected face high costs due to lack of competition on international gateways.	Achieving regional integration of ICT will cost only $5.1 million annually, and bring benefits of $ 115 million annually, a return of more than 400 percent. Benefits derive primarily from lower prices inducing higher rates of subscription to broadband services. The overall rate of return on regional integration investments (existing greenfield and filling of gaps) is 52 percent.

Source: AICD.

Note: BAG = Banjul Access Group; WAEMU = West African Economic and Monetary Union; WAPP = West African Power Pool.

2 Transport

Figure 2.1a Condition of ECOWAS's regional road network

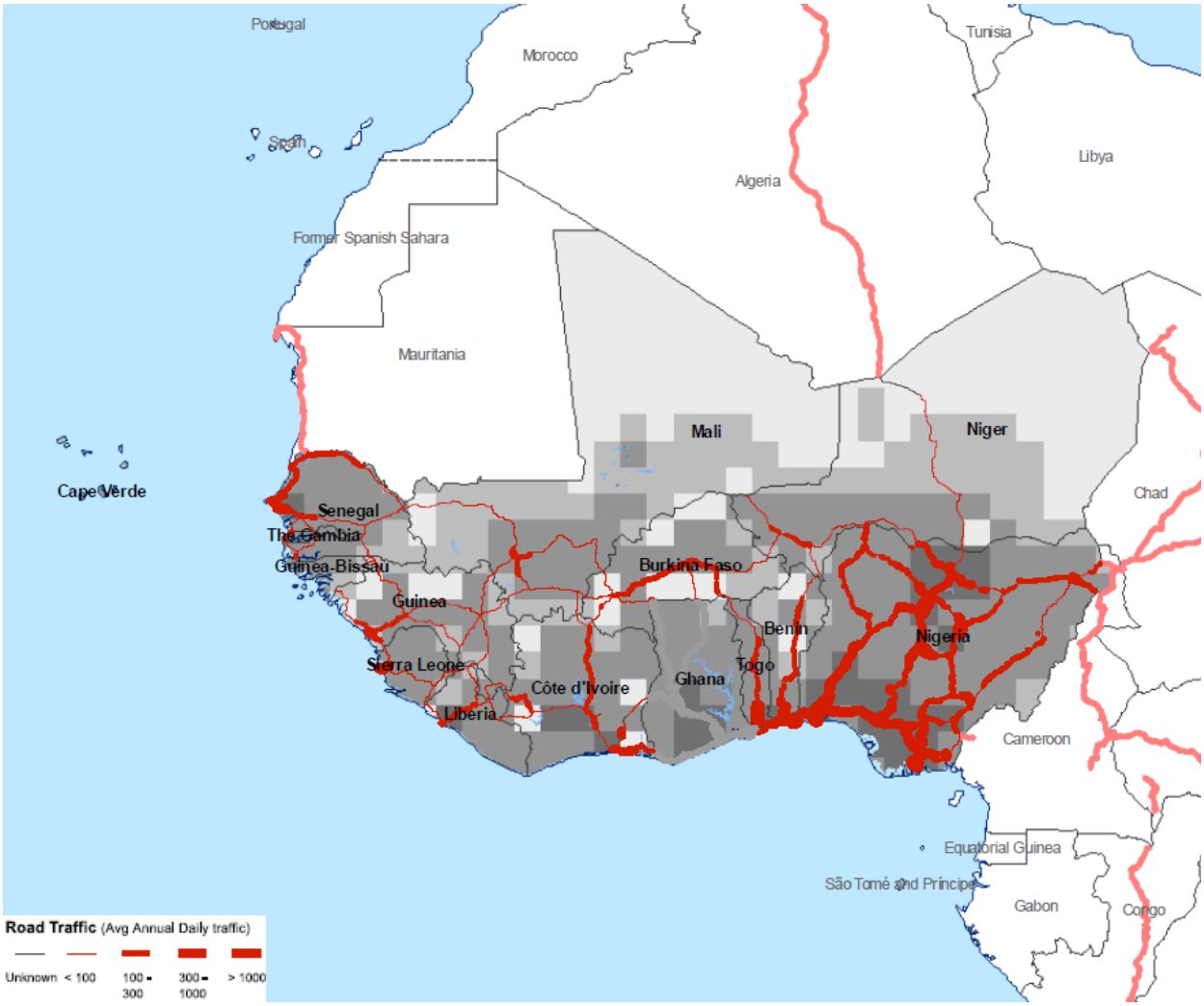


Source: AICD.

Surface transport

Surface transport of goods in Africa is much slower and costlier than elsewhere in the developing world. Across the developing world, freight can typically be moved at rates of between $0.01 to $0.04 per tonne-kilometer. A recent study of road transport costs and prices across Africa found rates of between $0.05 to $0.13 per tonne-kilometer; well above the global benchmark. It also found that—despite the relatively good condition of the road corridors (figure 2.1a)—freight movements are astonishingly slow when all delays are fully taken into account; with an effective velocity of 6–12 kilometers per hour, not much faster than a horse and buggy (table 2.1).

Figure 2.1b Traffic on ECOWAS's regional road network



Source: AICD.

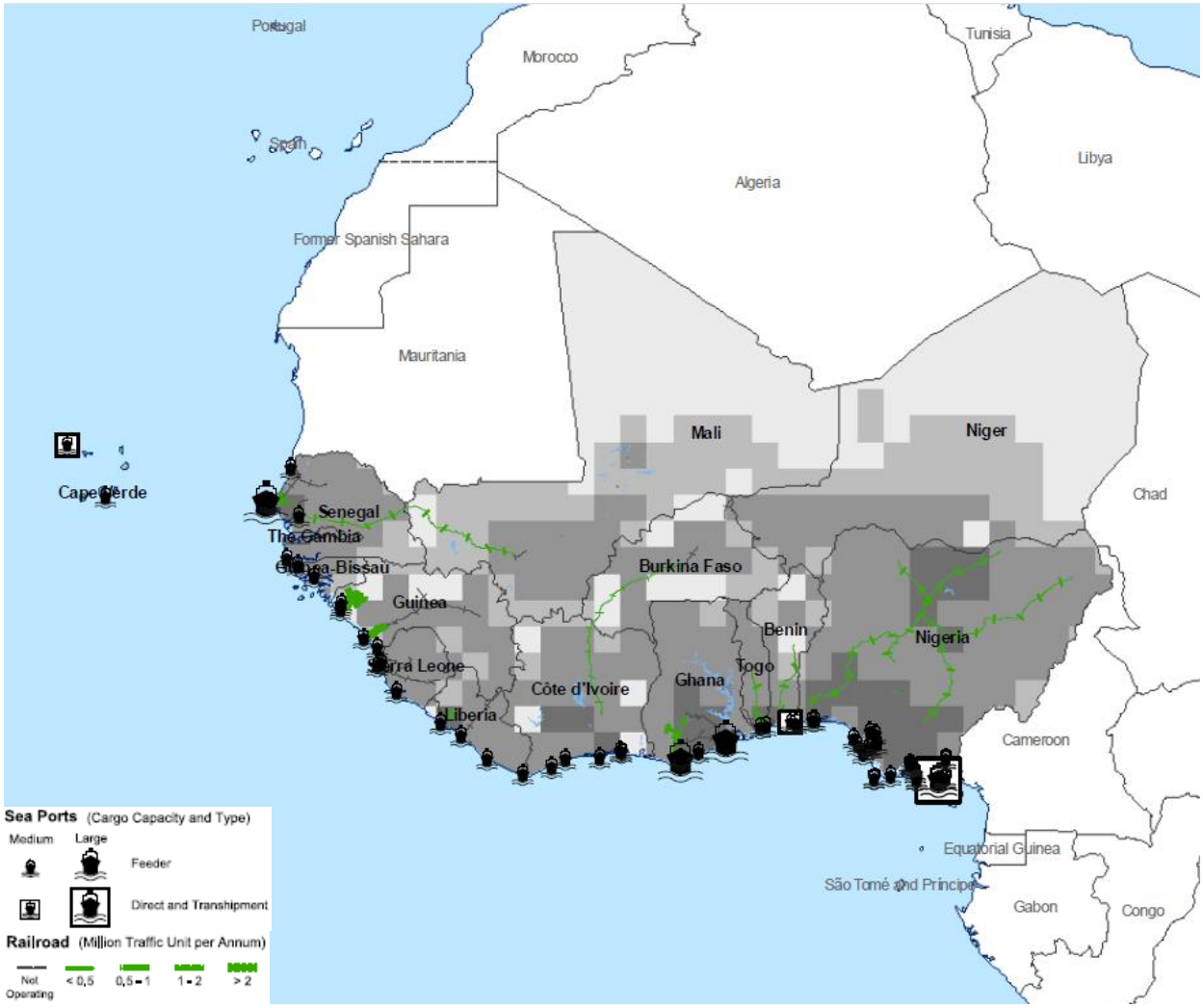
Table 2.1 Relative performance of transport corridors in Africa

Corridor	Length (kms)	Road in good condition (%)	Trade density (US$ millions per km)	Implicit velocity* (km per hour)	Freight tariff (US$ per tonne-km)
Western	**2,050**	**72**	**8.2**	**6.0**	**0.08**
Central	3,280	49	4.2	6.1	0.13
Eastern	2,845	82	5.7	8.1	0.07
Southern	5,000	100	27.9	11.6	0.05

*Implicit velocity is the total distance divided by the total time taken to make the trip including time spent stationary at ports, border crossings and other stops

Source: Teravaninthorn and Raballand 2008.

Figure 2.1c ECOWAS's regional railways and ports



Source: AICD.

Transit corridors in West Africa perform significantly worse than those in southern and eastern Africa. Across the different regions of Africa, performance varies dramatically. Southern Africa is well ahead of the other regions, with the lowest road freight tariffs and the fastest movement of goods. But West Africa does not compare very favorably with the other regions, either. Road freight tariffs, at $0.08 per tonne-kilometer, are toward the middle of the African range. The effective velocity of road transport, at six miles per hour, is the worst reported for any region.

High road freight charges in West Africa can largely be explained by a cartelized trucking industry operating under restrictive regulations. Analysis of cost information provided by trucking firms indicates that the high road freight charges in the region are not attributable to higher costs, but rather to larger profit margins made possible by limited competition within industry cartels. Trucking industry profit margins in West Africa were found to be on the order of 80 percent, compared with 20–60 percent in southern Africa. In addition, the *tour de rôle* regulatory framework is based on market sharing ("taking turns") and centralized allocation of freight. This limits vehicle mileage to around 2,000 kilometers per

month, versus 12,000 in the developed world, and undermines incentives for investing to improve service quality. Hence, the truck fleet is largely composed of poorly maintained second-hand trucks that are typically overloaded to obtain maximum revenues from their restricted usage. There is typically excess supply, with too many vehicles chasing modest overall freight volumes. In southern Africa, by contrast, a much larger share of freight traffic is allocated through competitive bilateral contracts between clients and shippers. These considerations make the liberalization of the trucking industry a key measure to improve regional surface transportation in West Africa. Indeed, until the regulatory framework for the trucking industry is modernized, there will be no real economic benefit from further improvements to the quality of road corridors.

The slow effective velocity of freight in West Africa can be explained in terms of numerous roadblocks and lengthy administrative delays at ports and border crossings. There is ample evidence of extensive delays at West Africa's land border crossings. Port processing times are also lengthy. In addition, a number of recent studies confirm that roadblocks (both formal and informal) are rampant on West Africa's major transit corridors. Ad hoc administrative hurdles, corruption, and other informal payment demands contribute to a high level of uncertainty in land transport. For example, a 2009 report from the U.S. International Trade Commission mentions that "trucks in Ghana traveling from Paga (on the northern border with Burkina Faso) to Tema (on the Gulf of Guinea) take two to four days under normal conditions, but an estimated 10–20 percent of trucks are delayed by a week or more; moreover, if a truck breaks down on this route, it can take up to three weeks to procure a mechanic from Kumasi in south-central Ghana" (Christ and Ferrantino 2009).

ECOWAS's landlocked countries—Burkina Faso, Mali and Niger—each has more than one gateway to the sea, in contrast to landlocked countries in other regions of Africa (figure 2.2a). Ouagadougou (Burkina Faso) has access to both Tema (Ghana) and Abidjan (Côte d'Ivoire). Bamako (Mali) has access to both Dakar (Senegal) and Tema (Ghana). Niamey (Niger) has access to both Cotonou (Benin) and Lomé (Togo). The existence of multiple corridors provides choice and helps to create competition. Some studies indicate that in Western Africa, average clearance time is shorter than in other parts of Africa (Christ and Ferrantino 2009). For example, the time from a ship's arrival to its clearance in Ouagadougou (Burkina Faso) is limited to 10–15 days, which is comparable to, or better than, ports in other parts of the world. The relatively good performance is due in part to the competition between ports on the Gulf of Guinea to capture transit trade in ports (Christ and Ferrantino 2009; Arvis, Raballand, and Marteau 2009). The presence of multiple gateways also diversifies risk: During the disruption caused by the recent civil war in Côte d'Ivoire, Burkina Faso was able to divert traffic via Ghana.

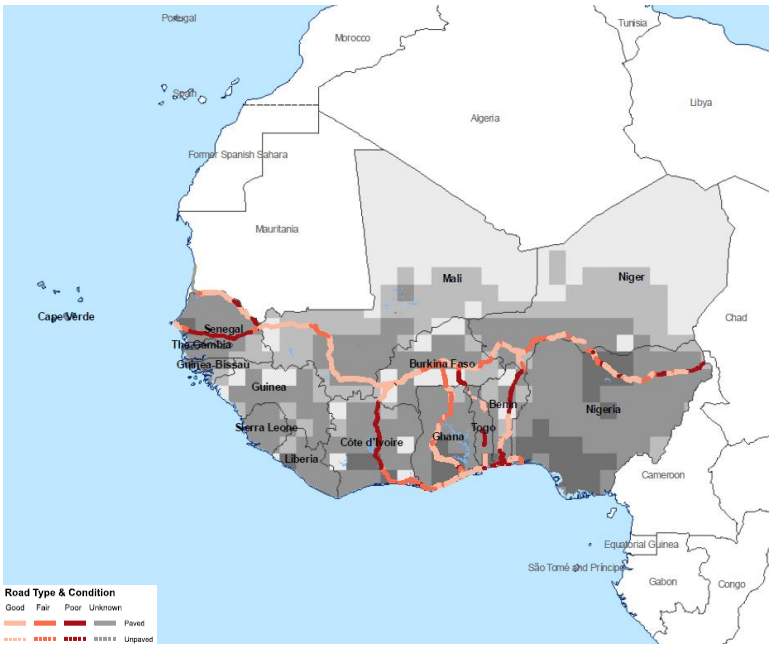
Two key corridors are also emerging in support of intraregional trade. ECOWAS's large number of small countries, makes for numerous borders within the region, so that trade facilitation looms large with respect to intraregional trade. The two key internal corridors that have emerged are the coastal corridor from Abidjan (Côte d'Ivoire) to Lagos (Nigeria), and the Sahelian corridor running from Nouakchott (Mauritania) to N'Djamena (Chad). The coastal corridor could in principle be extended all the way to Dakar (Senegal), but because so many countries along the route have just emerged from conflict, this corridor has not yet become a reality.

Regional corridors are typically paved and in reasonable condition, but there is evidence that coastal countries may be neglecting strategic hinterland routes. ECOWAS's seven key regional corridors are

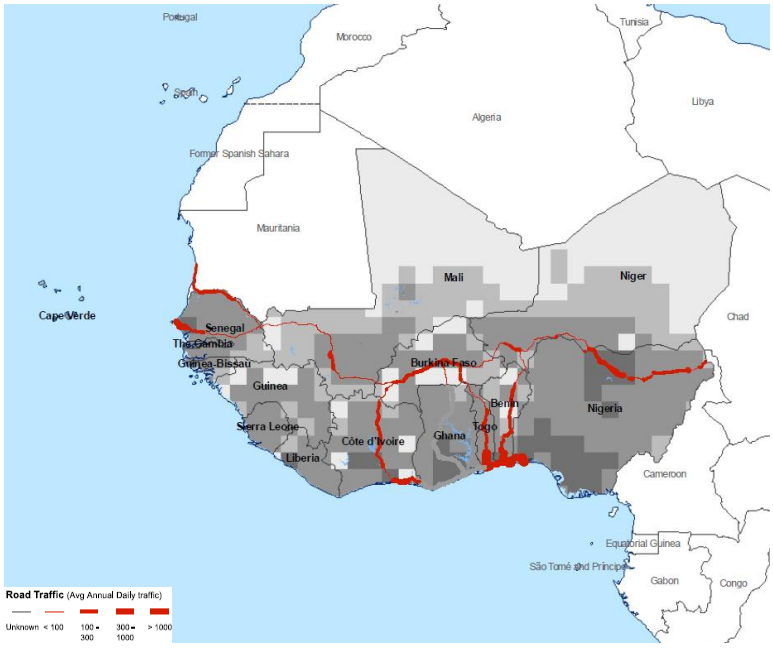
almost entirely paved, and in most cases road infrastructure is mainly in good or fair condition (table 2.2, figure 2.1a, figure 2.2a). More than 95 percent of the length of the key regional corridors is paved in just about every country along the way. In most cases, at least 80 percent of each corridor by length is in good or fair condition.

Figure 2.2 ECOWAS's seven main regional road corridors

a. Road condition



b. Traffic volumes



Source: AICD.

Note: Background show GDP per 100 square kilometers on grey scale.

Table 2.2 Road condition along major transit corridors in ECOWAS

	Percentage in condition				Percentage in traffic band		
Corridors	Good	Fair	Poor	Percentage Paved	<300	300-1000	>1000
GATEWAYS TO THE SEA							
Tema-Ouagadougou-Bamako	***67.1***	***30.7***	***2.2***	***100.0***	***3.8***	***25.7***	***25.4***
Burkina Faso	52.4	47.6	0.0	100.0	8.3	31.0	60.7
Ghana	62.8	32.5	4.8	100.0	0.0	0.0	0.0
Mali	100.0	0.0	0.0	100.0	4.7	72.0	23.2
Dakar-Bamako	***48.0***	***19.8***	***32.1***	***100.0***	***24.9***	***55.6***	***19.5***
Mali	75.6	24.4	0.0	100.0	46.7	47.2	6.1
Senegal	16.6	14.6	68.8	100.0	0.0	65.2	34.8
Abidjan-Ouagadougou	***33.1***	***23.0***	***43.9***	***100.0***	***3.5***	***23.3***	***73.1***
Burkina Faso	68.6	27.3	4.1	100.0	4.1	27.6	68.3
Côte d'Ivoire	3.1	19.5	77.5	100.0	3.1	19.7	77.2
Lomé-Niamey	***50.2***	***30.1***	***19.8***	***100.0***	**0.0**	***82.6***	***17.4***
Burkina Faso	35.4	38.9	25.8	100.0	0.0	77.3	22.7
Niger	99.0	1.0	0.0	100.0	0.0	100.0	0.0
Togo	51.7	0.0	48.3	100.0	0.0	37.2	62.8
Cotonou-Niamey	***49.5***	***7.9***	***42.6***	***98.5***	***1.5***	***26.4***	***70.0***
Benin	38.1	2.2	59.7	97.8	2.2	15.8	81.5
Niger	77.7	22.3	0.0	100.0	0.0	52.8	41.4
INTRA-REGIONAL CORRIDORS							
Abidjan-Lagos	***50.7***	***28.0***	***20.6***	***98.8***	***0.0***	***0.4***	***43.6***
Benin	26.9	0.0	68.0	92.4	0.0	2.5	90.3
Côte d'Ivoire	0.0	100.0	0.0	100.0	0.0	0.0	100.0
Ghana	75.0	14.5	10.5	100.0	-	-	-
Nigeria	50.0	50.0	0.0	100.0	0.0	0.0	100.0
Togo	0.0	0.0	100.0	100.0	0.0	0.0	100.0
Nouakchott-Ndjamena	***63.4***	***21.1***	***10.2***	***97.3***	***9.9***	***46.2***	***43.4***
Burkina Faso	70.7	29.3	0.0	100.0	6.2	37.6	56.3
Cameroon	84.8	15.2	0.0	100.0	31.0	56.5	12.5
Mali	62.9	31.3	0.0	94.2	5.8	75.8	16.4
Mauritania	50.6	23.8	25.6	100.0	0.0	21.5	78.5
Niger	66.4	4.4	29.1	99.1	3.8	46.8	48.5
Nigeria	-	-	-	100.0	0.0	0.0	100.0
Senegal	10.9	26.5	62.6	28.6	0.0	100.0	0.0

Source: AICD calculations.

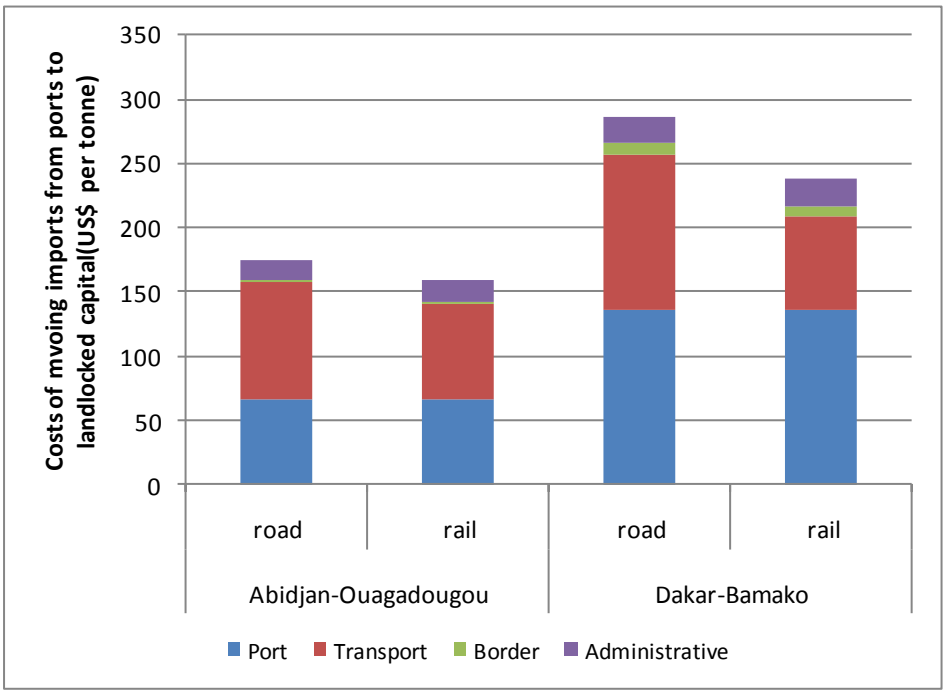
However, there are a few corridors where the percentage of the road in good or fair condition falls to the 60 to 70 percent range. These are Dakar to Bamako, Abidjan to Ouagadougou, and Cotonou to Niamey. What is striking in each of these cases is that the problem seems to lie in the neglect of road quality by the coastal gateway country. Thus, on the Dakar-to-Bamako route, 69 percent of the Senegalese portion is in poor condition. On the Abidjan-to-Ouagadougou route, 78 percent of the Ivorian portion is in poor condition. On the Cotonou-to-Niamey route, 60 percent of the Beninois portion is in poor condition. Clearly, the incentives for the coastal country to maintain hinterland road corridors do not seem to be very strong, since the coastal countries' economies are typically concentrated along the coast, making the up-country segments regional public goods.

Traffic along the key regional corridors is moderate to heavy in both cases; with the most heavily used routes typically those in poorest condition. The regional corridors almost always carry at least 300 vehicles per day along most of their length, and more than 1,000 vehicles per day on at least 20 percent of their length (table 2.2, figure 2.1b, figure 2.2b). Overall, the most heavily used corridors are the two gateways into Burkina Faso, and the Cotonou-to-Niamey route. Ironically, these are also some of the corridors in the worst physical condition. The Dakar-to-Bamako route is one of the most lightly used, perhaps reflecting the existence of a parallel rail corridor; although the Abidjan-to-Ouagadougou route is used intensively, despite the existence of the rail alternative. Otherwise, the portions of the corridors falling in the coastal countries tend to be the most heavily used, almost always attracting in excess of 1,000 vehicles per day. Nevertheless, in absolute terms, such traffic levels can be considered no more than moderate. After all, 300 vehicles per day is the minimum traffic threshold required for paving to be economically viable. And none of the corridors exceed the threshold of 10,000 vehicles per day needed for toll road concessions to be economically viable.

The cost of moving goods along each of these key arteries is a key constituent of competitiveness for both international and intraregional trade. These costs break down into three components: the travel costs of moving goods, determined by road and rail freight tariffs; the administrative costs of moving goods across borders and through ports, determined by associated service charges; and the costs of time delays incurred by waiting at roadblocks, border crossings, and ports. The competitiveness of the different corridors can be gauged by aggregating transport, administrative, and waiting costs incurred along the route.

In the few cases where parallel road and rail corridors exist, the rail option appears to offer the competitive edge. There are only two railways in West Africa connecting landlocked countries to the sea: the Sitarail corridor linking Abidjan to Ouagadougou and the Transrail corridor linking Dakar to Bamako (figure 2.3). Comparative analysis of these parallel road and rail corridors suggests that the railway usually has the upper hand, with a cost advantage on the order of 10 to 25 percent driven largely by the lower freight tariffs—$0.08 per tonne-kilometer by road against just over $0.06 per tonne-kilometer by rail. Unless rail freight encounters additional delays owing to the disrepair of the railways or service disruptions, it is cheaper than road transport for transferring goods from Mali and Burkina Faso to West African ports.

Figure 2.3 Comparative costs of exporting goods by road and rail where both exist



Source: Data collected from World Bank 2008, West Africa Trade Hub data, World Bank project documents, and AICD ports and railways database.

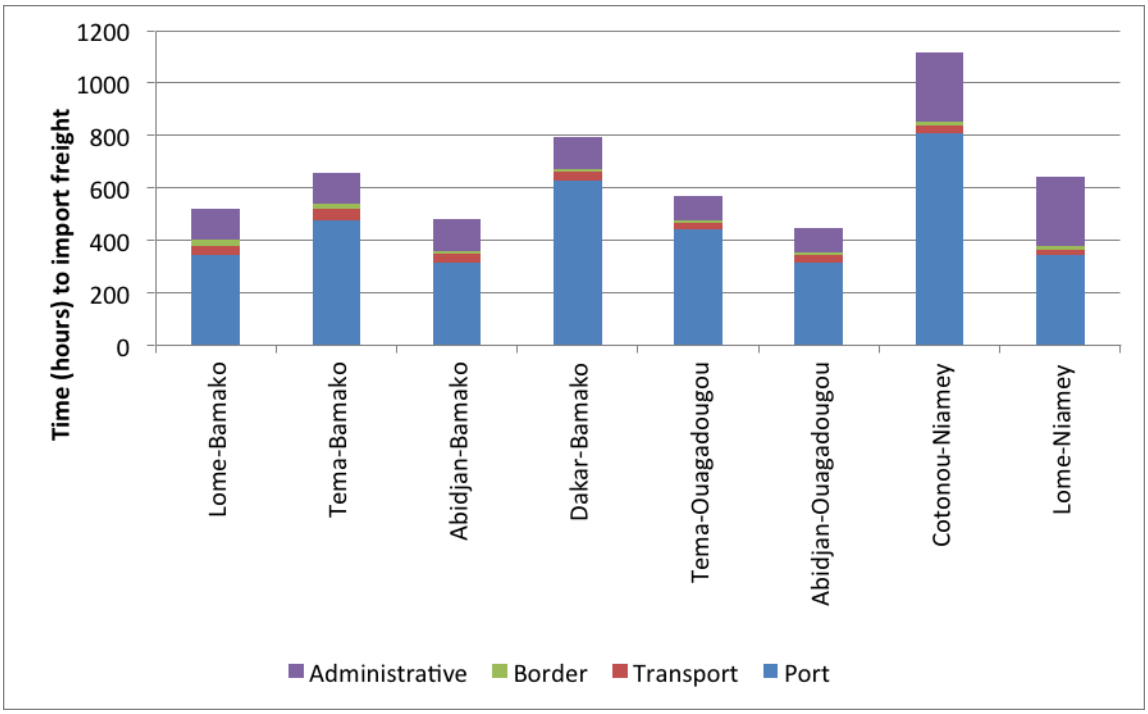
Prolonged dwell times at ports, delays in crossing borders, and customs clearance processes add significant amounts of time to moving imports along regional corridors from ports. There is significant variation across corridors in port efficiency, border crossing delays, and time required for customs, clearance, and technical control. The time required to move imports from ports to a landlocked country along the corridors takes anywhere from 400 hours (20 days) to 700 hours (48 days), close to double the times observed in southern Africa (figure 2.4a).

How that time is spent varies. Owing to long distances from landlocked capitals to ports, transport times contribute the lion's share to the total for importing freight, followed by expensive administrative processes (figure 2.4b)[1]. Other factors vary as well. For example, the Port of Lomé is far more efficient than the Port of Cotonou or Tema. Abidjan also records shorter delays at ports, giving the port a comparative advantage over its competitor ports (Teme Dakar and Lomé). Crossing West African borders has been described as a time-consuming ordeal. Previous estimates suggested that crossing Ghanaian borders took more than 20 hours (Teravaninthorn and Raballand 2008). Recent estimates for crossing the border between Ghana and Burkina Faso estimate the border-related delays to be between 6 and 8 hours (West Africa Trade Hub 2010a).. Customs processes, depending on final destination, are more expensive and often more time-consuming in West Africa than in southern Africa and parts of eastern Africa. In Niger, customs clearance processes takes up to 11 days.

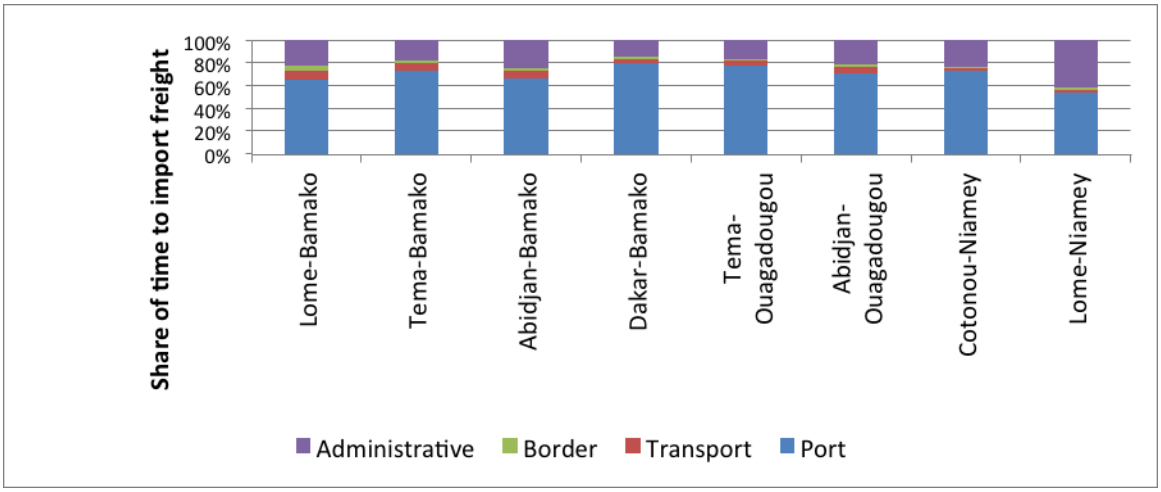
[1] The port sector appears to have improved significantly since 2006/07, when the data used for this analysis were collected.

Figure 2.4 Time required to import goods by road through alternative gateways

a. In hours



b. By step (% of total time)

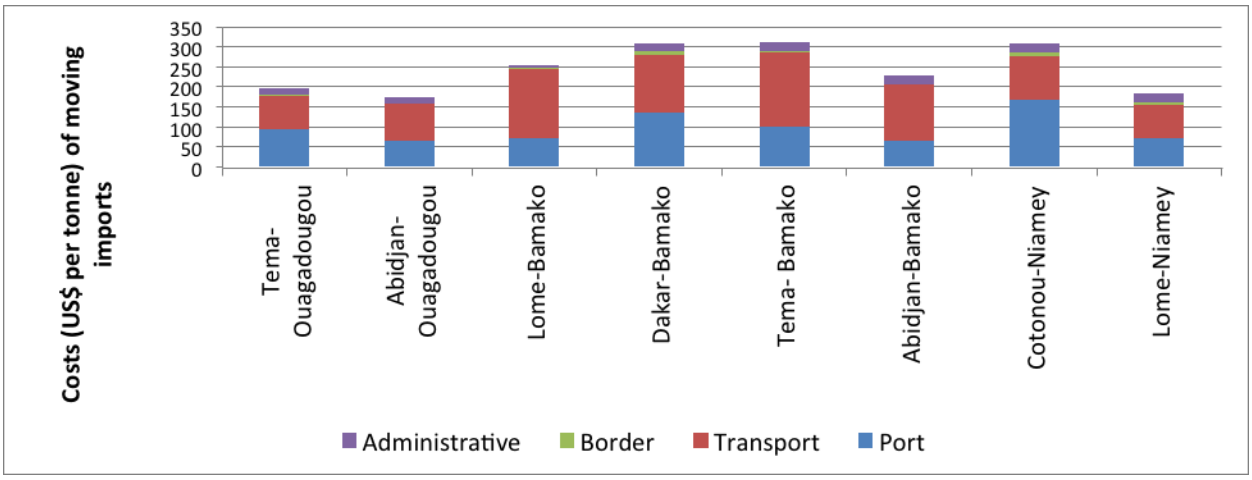


Source: Data collected from World Bank 2008," West Africa Trade Hub data, World Bank project documents, and AICD ports database (ports data from 2006/07).

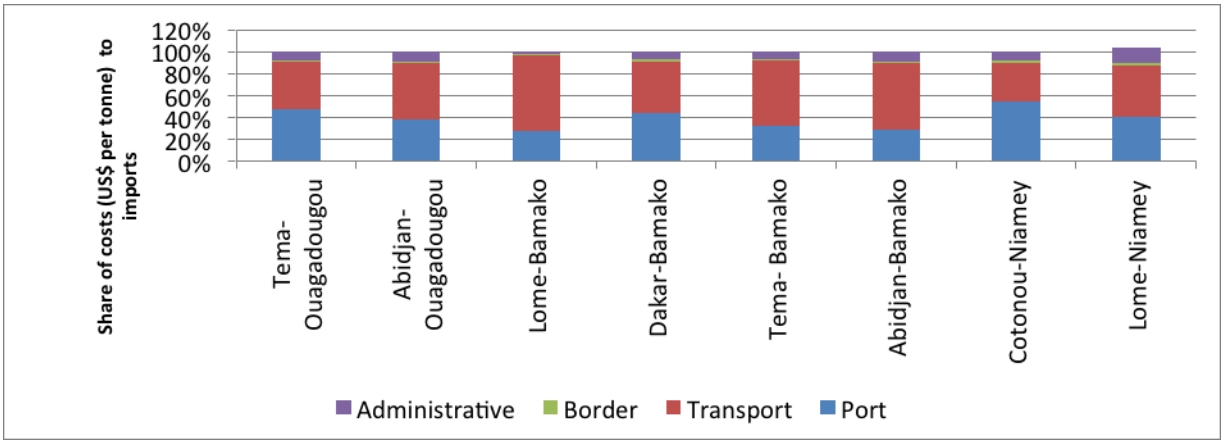
The costs of moving freight from ports to landlocked capitals is estimated to be between $175 and $310 per tonne (figure 2.5a)[2] and claim the lion's share of the total costs to import freight to landlocked countries (figure 2.5b). It costs around $310 per tonne to transport freight from Tema to Bamako or from Dakar to Bamako. Importing goods from Abidjan, however, is slightly cheaper ($228 per tonne) because the dwell times at the port are less than those at Tema and Dakar, giving Abidjan a slight competitive edge. The shorter average dwell time at Lomé gives it a significant edge over Cotonou, making it cheapter for Niger to import through Lomé than through Cotonou. In the wake of efforts to improve port efficiency in West Africa, delays are likely to shrink. Yet West Africa is also notorious for high costs associated with inspections, bribes, and other delays. Not surprisingly, long distances are linked with higher transport costs.

Figure 2.5 Cost of importing goods by road through alternative gateways

a. In U.S. dollars



b. By step (% of total cost)



Source: Data collected from World Bank 2008," West Africa Trade hub data, World Bank project documents, and AICD ports database (ports data from 2006/07).

[2] Prior research in Africa on the cost of delays was used to quantify the delays. The value was delays was estimated to be $5 per day per tonne.

Evidence collected over the years points to other significant delays encountered while transporting imports or exports from landlocked countries to coastal countries or vice versa. These delays come in the form of random checkpoints. Truckers routinely pay large bribes to get past these checkpoints. The route between Ouagadougo to Bamako has the highest density of checkpoints, around three per 100 kilometers (or 30 stops along the entire route). The Malian portion of the corridor is the worst, five stops per 100 kilometers (or 22 stops along the route). The lowest number of checkpoints per 100 km (1.8) is in Togo. Inspections also increase the time associated with moving along corridors. Inspections along the Tema-Ouagadougou at the border are reportedly very long, taking around four hours in Burkina Faso and seven in Ghana (West Africa Trade Hub 2010).

Reports indicate that the highest bribes are paid in Côte d'Ivoire along the routes between Abidjan and Ouagadougou (1,263 kilometers) and Abidjan to Bamako (920 kilometers), the former being the worst among those monitored (West Africa Trade Hub 2010b).[3] Bribe payments along the Abidjan-Ouagadougou corridor amount to $185.27, or more than $14 per 100 kilometers. More than $120 of that amount is paid in Côte d'Ivoire. Similarly, drivers along the corridor from Abidjan to Bamako pay almost $150 in bribes, and about $95 of this total is reportedly paid in Côte d'Ivoire. Various studies provide slightly different estimates for the extent of the bribery, but there is no doubt that corruption and informal payments impose a huge economic burden by raising costs (box 2.1).

Box 2.1 Racketeering and bribery along the roads of Côte d'Ivoire, Burkina Faso, and Ghana

A recent study by the World Bank, in coordination with the government of Côte d'Ivoire, revealed racketeering by Ivorian security forces that has created serious roadblocks along the country's transport corridors. The roadblocks constitute enormous obstacles to free movement of goods and people and have caused large economic losses and social distress. In Abidjan, before 2008, about 70 percent of communal taxis (*woroworo*) and minibuses (*gbaka*) had to stay off the roads for lack of proper documents. Lack of documents often prompted racketeering.

Apart from its negative impact on economic activity, racketeering costs transport operators in Côte d'Ivoire between $230 and $363.3 million annually. Along the Abidjan-Agboville road, minibuses take 90 minutes to cover 85 kilometers, and drivers paid $31.50 in illegal bribes to defense and security forces. The bribes collected each year by the authorities vary between $173.6 and $456 million for passenger transport and between $54.8 and $68.5 million for transport of goods. One encounters from 4 to 10 roadblocks per 100 km. Racketeering results in delays of as much as 30 minutes on the main highways at each checkpoint.

The government of Cote d'Ivoire has started a program to crack down on this problem, and results are already apparent (Alami 2010).

The so-called onion corridor—the route between Burkina Faso and Ghana that is used to transport onions from Niger and Burkina Faso—also records high levels of bribes. Uniformed officials use the perishable nature of the products transported to extort money from carriers and traders. Corrupt agents realize that additional delays can seriously deteriorate the quality of the perishable freight. Rather than losing time at barriers, drivers pay hefty bribes to get through the checkpoints faster.

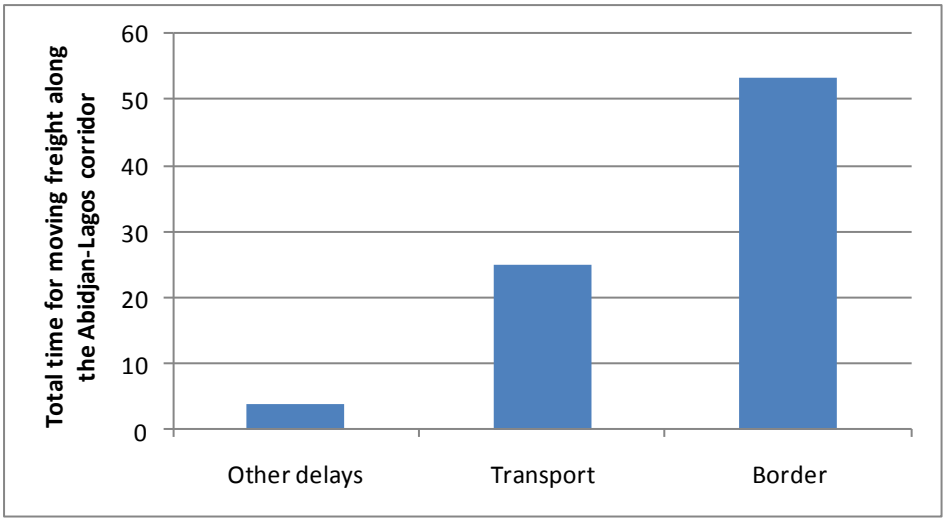
Source: Alami 2008; West Africa Trade Hub 2010c.

[3] Corridors monitored by the Road Harassment Initiative (a part of West Africa Trade Hub) include Tema-Ouagadougou, Ouagadougou-Bamako, Lomé-Ouagadougou, Bamako-Dakar, Abidjan-Ouagadougou, and Abidjan-Bamako.

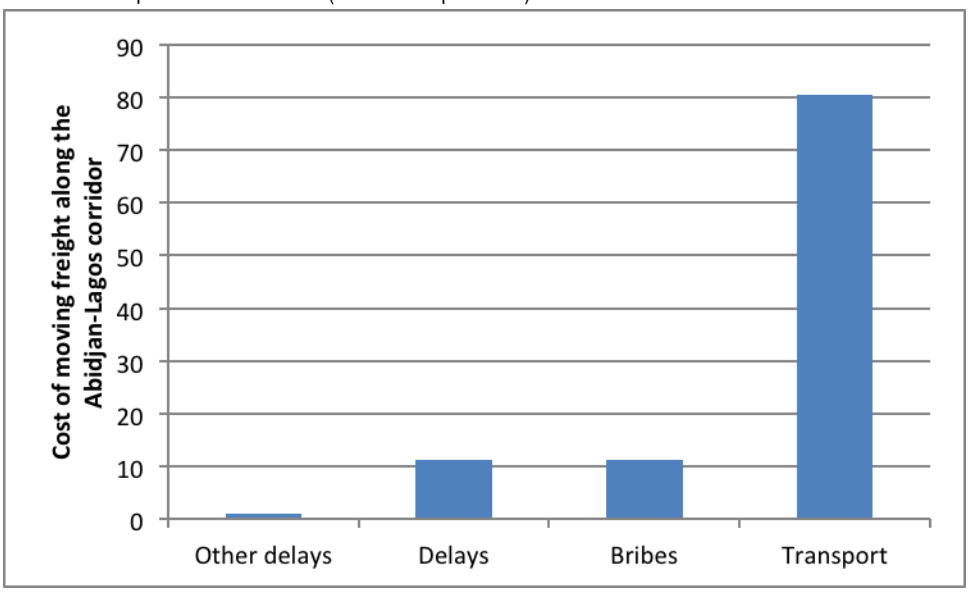
Moving along the coastal corridors is also time consuming and expensive. The Abidjan–Lagos corridor is the intercoastal highway that connects areas of high economic density in West Africa. While landlocked country gateways typically cross at most two land borders, the Abidjan–Lagos corridor passes through *five*. Freight moving along the corridor takes almost 4 days to reach Lagos from Abidjan, a distance of around 1,000 kilometers. The longest delays are associated with border crossings followed by other events such as police stops, customs, immigration, and union activity (figure 2.6). Delays at the borders add over two days to the travel time. Moving freight to Lagos from Abidjan is associated with costs around $104 per tonne. Recent studies suggest that bribes paid along the way add over $300 per truck to the transport costs (West Africa Trade Hub 2010c) .

Figure 2.6 Time required to move imports from Abidjan to Lagos

a. Hours required for transport and other events



b. Cost of transport and other events (U.S. dollars per tonne)



Source: Derived from West Africa Trade Hub 2010c.

In order to understand overall corridor performance, it is helpful to examine the national performance of the various modal components. The performance of the corridor can only be as good as the performance of the national transport systems of which it is comprised. To this end, the performance of the national road, rail and ports sectors is briefly reviewed in the remainder of the section, with a view to identifying national weaknesses that may have serious repercussions at the regional level.

Roads

Most ECOWAS countries have paved their portion of the regional network, except for a handful of postconflict countries. This section takes a national perspective on the regional road network. For these purposes, the regional road network is defined as the network needed to connect all national capitals with each other and with the major deep sea ports. Overall, 93 percent of this network has been paved (table 2.3). Most ECOWAS members have made the investments necessary to pave the portions of the regional network that fall within their borders. The only exception to this pattern is The Gambia and postconflict countries such as Liberia and Sierra Leone, where a substantial share of the regional network remains unpaved.

However, ECOWAS members vary substantially in the quality of their maintenance of the regional road network. Overall, 73 percent of the regional network is in good or fair condition (table 2.3). As a general rule, most member countries are succeeding in maintaining their portions of the regional network in good or fair condition. However, there are five important exceptions to this pattern. Côte d'Ivoire, Senegal, Togo, Guinea, and Benin have allowed 30 to 60 percent of their regional networks to fall into poor condition. This may be symptomatic of wider deficiencies in the funding and implementation of road maintenance works in these countries, or it may denote a lack of prioritization to regional routes within the national road plans. Consistent with earlier findings, all of the countries with deficient maintenance are located on the coast.

Table 2.3 Condition of ECOWAS regional road network by member country

Percent

	Condition				Type		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Benin	35.8	1.8	61.5	1	96.8	3.2	0.0
Burkina Faso	58.2	33.6	8.2	0	100.0	0.0	0.0
Côte d'Ivoire	16.1	47.1	35.4	1	90.3	9.7	0.0
Gambia	0.0	89.4	10.6	0	47.4	34.4	18.2
Ghana	70.3	23.6	6.1	0	100.0	0.0	0.0
Guinea	22.2	20.7	57.1	0	89.1	10.9	0.0
Guinea-Bissau	0.0	0.0	0.0	100	0.0	0.0	100.0
Liberia	39.4	55.9	2.7	2.1	47.5	52.5	0.0
Mali	66.6	21.7	0.0	11.7	99.6	0.4	0.0
Niger	31.2	31.0	0.0	37.7	88.0	12.0	0.0
Nigeria	55.6	29.7	14.7	0	100.0	0.0	0.0

	Condition				Type		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Senegal	39.8	15.1	45.1	0.0	99.8	0.2	0.0
Sierra Leone	19.5	58.4	22.1	0.0	33.6	66.4	0.0
Togo	49.7	0.0	50.3	0.0	100.0	0.0	0.0
ECOWAS	45.1	28.4	22.5	4.0	92.5	7.4	0.1

Source: AICD various sources

Railways

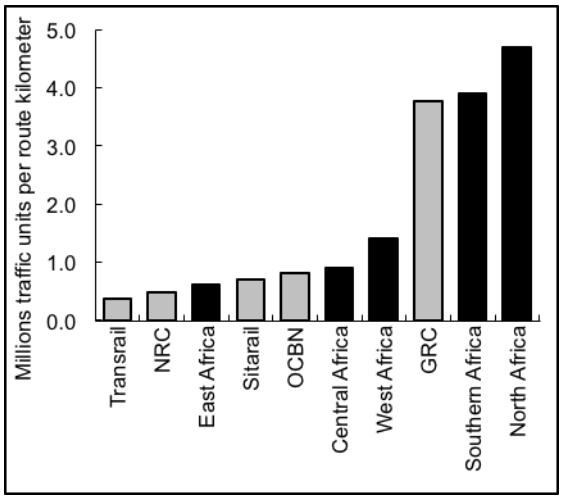
Unlike the situation in southern Africa, there is no real regional rail network in the ECOWAS area, nor are the rail gauges internally compatible. In fact, the national rail networks of ECOWAS's member states are mostly disconnected from each other. This is in contrast to southern Africa, where interconnected national railway systems form a regional railway network that spans half a dozen countries and extends from the southern part of the Democratic Republic of the Congo all the way to Durban in South Africa. Further integration of West Africa's rail systems is complicated by the presence of multiple rail gauges. Ghana and Nigeria have the Cape gauge (1,067 millimeters in width). Most of the francophone countries (Benin, Burkina Faso, Côte d'Ivoire, Mali, Senegal, and Togo) operate the meter gauge (1,000 millimeters in width). Guinea and Liberia use the standard gauge (1,435 millimeters in width).

The case for further regional integration of railway networks is constrained by the relatively limited usage of existing lines. Rail traffic density in West Africa is only a fraction of that found in southern Africa and North Africa (figure 2.7). With the exception of Ghana Railways Corporation (GRC), most of West African railways are serving well under one million traffic units per year. (The Nigeria Railways Corporation could potentially serve a much higher volume of traffic than it does today, but it has suffered long-term decline due to neglect and substandard performance.) By global standards, these levels of traffic are little more than what might be carried by a moderately busy branch line. Moreover, such low traffic volumes do not generate the revenue needed to finance track rehabilitation and upgrading. Under these market conditions, and given the technical incompatibilities, the case for further integration of railway networks is quite limited.

Before contemplating further extensions to the rail network, a turnaround in the performance of existing railways is sorely needed to regain competitiveness with road transport. The poor quality of service provided by West Africa's railways makes it increasingly difficult for them to compete with road transportation. Most railways in West Africa operate at the standard at which they were originally built and now face major problems with competing modes of transport. West African tracks can accommodate relatively lightweight and slow-moving trains. Poor maintenance over extended periods of time has caused the deterioration of many sections of the track beyond repair and resulted in a loss of competitiveness and rolling-stock productivity. While such inefficiencies can be tolerated on low-volume feeder lines and may be the only way some can be viably operated, they are a major handicap when competing against the modern roads being built in major corridors.

Passenger rail services are proving too slow and irregular to compete with intercity buses. For example, between Ouagadougou and Bobo Diassollou in Burkina Faso, there are frequent buses, taking about five hours. A single train that runs three times a week provides service between these two cities, en route from Abidjan and Ouagadougou. By rail, the trip takes nine hours and is subject to frequent delays. Perhaps not surprisingly, the bus is reported to have 95 percent of the market between the two cities.

Figure 2.7 Traffic density on African railways



Source: Bullock 2009.

Note: Density is normally expressed as traffic units per route-km. The traffic units carried by a railway are the sum of the passenger-km and the net tonne-km.

Road transport is being increasingly used for transport of minerals more naturally suited for rail transportation. In Ghana, for example, bauxite and manganese headed to the port of Takoradi have been the dominant freight on GRC for over a decade, representing about 90 percent of the tonnage loaded. But most years, GRC has been unable to carry all the traffic owing to a lack of rolling stock (aggravated by poor infrastructure that has limited operating speeds and thus extended cycle times) or, as in 2008, to a strike. The traffic that could not be accommodated has gone by road at an additional cost of $1 per tonne for the manganese ore and even more for the bauxite. Similarly, in Niger, the road-rail service that was offered by OCBN was used to transport goods from Niamey to Cotonou in Benin. However, because of competition from road carriers, a majority of customers have abandoned the rail service. The share of Niger's containerized imports (such as petroleum products, cereals, sugar, sulfur) going by rail decreased from 88 percent of Niger's total imports in 1992 to 77 percent in 1998 and 34 percent in 2005. Similarly, the share of Niger's cereal traffic going by rail dropped from 98 percent in 1992 to 3 percent in 2005.

West Africa does, however, have two relatively successful binational railway systems. The rail lines serving landlocked Mali and Burkina Faso via Senegal and Côte d'Ivoire respectively have been developed as integrated operations—Transrail and Sitarail—linking the landlocked capitals to coastal ports. In contrast to arrangements in much of southern Africa, this configuration allows for smooth passage of goods across national borders and avoids the lengthy delays otherwise associated with the switching of locomotives as freight moves from one national network to another. The concession arrangements for these two railways have helped to boost operational efficiency, so that measures of labor and rolling stock productivity show substantially better performance than for the region's major publicly owned railways (table 2.4).

Table 2.4 Comparative performance across West African railways (2005)

	Labor productivity	Locomotive productivity	Carriage productivity	Wagon productivity	Average passenger yield	Average freight yield
Benin, OCBN	40	3	900	74	2.0	5.8
Burkina Faso – Côte d'Ivoire, SITARAIL	481	35		1,020	3.3	5.5
Ghana, GRC	84	7	416	458	2.4	4.4
Mali – Senegal, Transrail	339	40		804	2.2	6.4
Nigeria, NRC	37	13	737	59	—	—
SSA average for railways under concession	387	24	2,945	510	2.2	6.3

Legend: Labor productivity = '000s traffic units per employee; Locomotive productivity = millions of traffic units per locomotive; Carriage productivity = '000s passenger-kilometers per carriage; Wagon productivity = '000s net tonne-kilometers per wagon.
Source: AICD railways database.

Ports

Container and general cargo traffic moving through West Africa's ports increased substantially between 1995 and 2005. The annual average growth in container traffic was even higher than in other parts of Africa, whereas growth in general cargo, however substantial, was not as rapid as in southern Africa (table 2.5). Overall growth in containerized traffic growth was propelled by rapid economic growth in Sub-Saharan Africa, a rising tide of global trade, the privatization of ports, and the advent of modern container vessels.

With the rapid expansion of traffic, a few of the region's ports are beginning to experience capacity constraints (figure 2.8). This is most notable in the case of Cotonou (Benin), where both container and general cargo traffic significantly exceed design capacity. The port of Tema (Ghana) is also experiencing capacity constraints with respect to container traffic. There is some scope for easing those constraints by improving the efficiency of port performance, although new investments ultimately will be required.

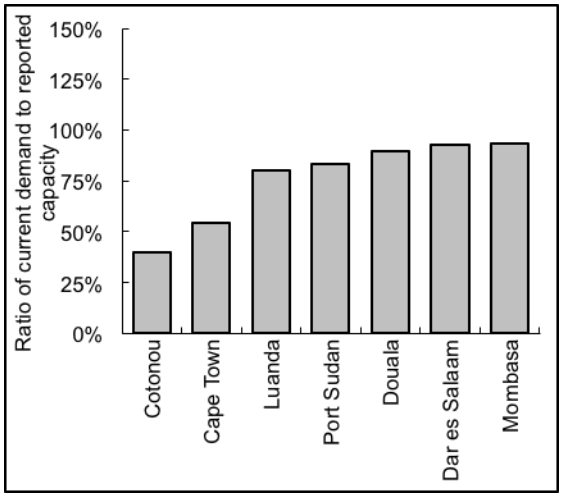
Table 2.5 Growth in containerized and general cargo traffic in West African ports between 1995 and 2005

	CONTAINER TRAFFIC				GENERAL CARGO TRAFFIC			
	TEUs		Percentage		'000s tonnes		Percentage	
	1995	2005	Overall growth	Average annual growth	1995	2005	Overall growth	Average annual growth
East Africa	505.1	1,395.0	+276	+10.7	13.8	38.4	+278	+10.8
North Africa	1,637.3	5,267.9	+322	+12.4	12.3	16.5	+134	+3.0
Southern Africa	1,356.0	3,091.8	+228	+8.6	2.7	14.5	+532	+18.2
West Africa	**1,035.4**	**4,082.0**	**+394**	**+14.7**	**23.1**	**61.2**	**+265**	**+10.2**
Total	4,533.8	13,836.7	+305	+11.8	52.0	130.7	+251	+9.7

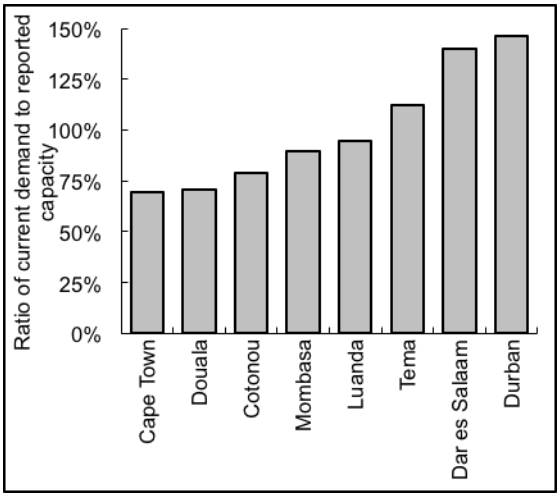
Source: Ocean Shipping Consultants Limited 2009.

Figure 2.8 Ratio of current demand to reported capacity in West African ports

a. General cargo



b. Container traffic



Source: AICD Ports Database, 2008.

The performance and charges of West African ports do not compare favorably with the rest of Africa, let alone with global best practice (table 2.6). Compared with global best practice, Africa's ports are expensive to use and subject to extensive delays. Southern African ports tend to perform somewhat better than those in other regions across a range of parameters. The services provided by West African ports generally cost twice as much as those in other global ports. Crane productivity in ECOWAS ports, in terms of containers or weight, is less than half the international benchmark. Global best practice for truck cycle time is one hour—it takes up to 10 hours in West African ports. The international standard for the time containers spend in the terminal (dwell time) is seven days or less, but in West Africa, most containers dwell more than two weeks. The result is terminal congestion and port inefficiencies. Incentives for speedier pickups might include a daily storage charge after a given number of free days and specific rules to prevent the dumping of empty containers at the terminal. Unlike in West Africa, most southern African terminals offer a given number of free days' storage—typically up to seven days—and thereafter apply a daily storage charge, sometimes on a sliding scale increasing with the number of days.

Table 2.6 Comparative port performance across African regions

	East Africa	Southern Africa	**West Africa**	Global best practice
Performance				
Container dwell time (days)	5–28	4–8	**11–30**	<7
Truck processing time (hours)	4–24	2–12	**6–24**	1
Crane productivity (containers per hour)	8–20	8–22	**7–20**	20–30
Crane productivity (tonnes per hour)	8–25	10–25	**7–15**	>30
Charges				
Container handling (US$ per TEU)	135–275	110–243	**100–320**	80–150
General cargo handling charge (US$ per tonne)	6–15	11–15	**8–15**	7–9

Source: AICD ports database.

Performance of individual ports in ECOWAS countries varies (tables 2.7). Ports in Nigeria and Ghana seem to perform significantly worse than others in terms of efficiency. Container dwell times are particularly high, exceeding one month in a number of cases. Abidjan (Côte d'Ivoire), Cotonou (Benin), Dakar (Senegal), and Lomé (Togo) all present significantly better performance on efficiency. Container dwell time is as low as seven days in Dakar, putting it close to global best practice. Crane productivity in Lomé is 23 tonnes per hour, substantially better than elsewhere, although still short of the international benchmark. The ports that perform best are often those that charge the most. Container handling costs are well above $200 per TEU in Abidjan and Lomé, or about twice the global benchmark. General cargo handling is around $15 per tonne in Abidjan and Dakar, again about twice the global benchmark.

Table 2.7 Comparative performance across West African ports

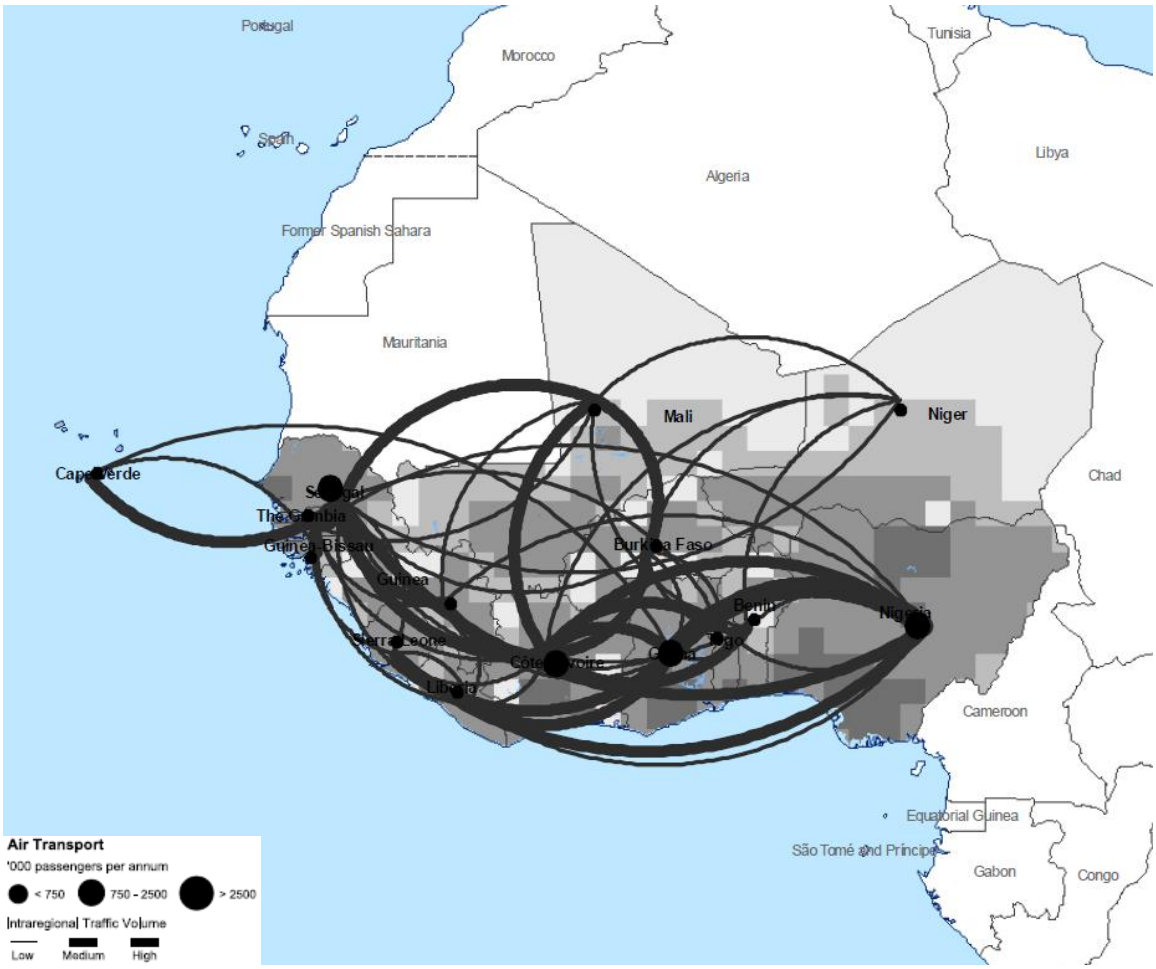
	Abidjan	Apapa	Cotonou	Dakar	Harcourt	Lomé	Tema
	Côte d'Ivoire	Nigeria	Benin	Senegal	Nigeria	Togo	Ghana
Performance							
Container dwell time (days)	12	42	12	7	30	13	25
Truck processing time (hours)	3	6	6	5	24	4	8
Crane productivity (containers per hour)	18	12	—	—	—	—	13
Crane productivity (tonnes per hour)	16	9	15	—	8	23	14
Charges							
Container handling (US$ per TEU)	260	155	180	160	—	220	168
General cargo handling (US$ per tonne)	14	8	9	15	8	9	10

Source: AICD ports database.

ECOWAS needs better transshipment links. Although Abidjan has enjoyed some success as a container transshipment center, it has suffered in recent years from internal strife and problems relating to the ownership of operating rights to the container terminal. It is clear that the West African coast requires another major transshipment center. One testament to this is that the major carriers engaged in West African container trade, Maersk Line and its affiliate Safmarine, now use the port of Malaga, Spain, as their hub for West African container trade. They relay West African cargo moving to or from Europe and Asia there, and handle other key trades there as well. As a general rule, transshipment traffic tends to become a casualty as ports reach capacity constraints, as has recently occurred in several of these hubs. Nigerian ports play an important role in the transshipment of liquid cargo—mainly oil. Liquid cargo transshipment has been concentrated around the oil exporters, with Nigeria being the largest in the continent.

Air transport

Figure 2.9 ECOWAS's regional airports and air traffic flows



Source: AICD

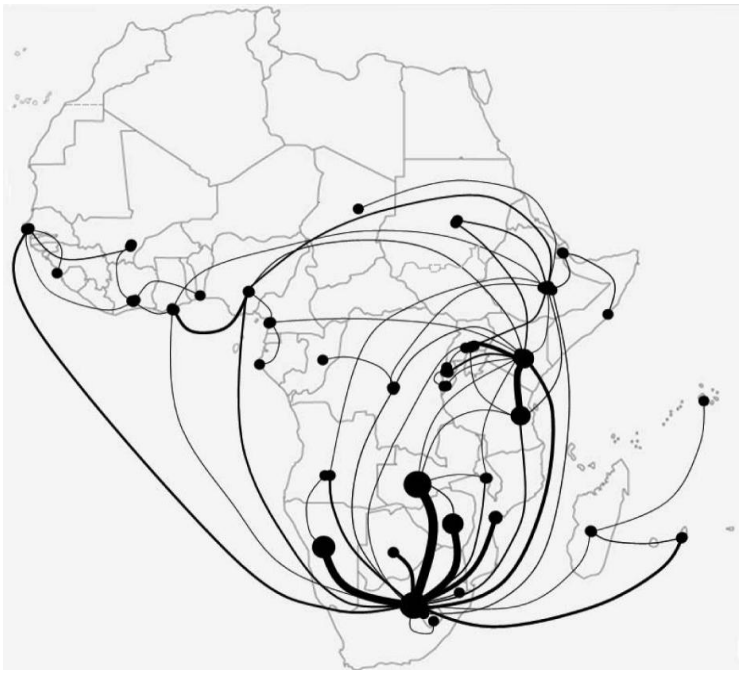
Viewed from a continental perspective, there is an absence of strong regional air transport hubs in the ECOWAS region. The map of the top 60 intracontinental routes in Africa highlights the main traffic patterns across the continent (figure 2.10). While none of Africa's Sub-Saharan airports (with the possible exception of Johannesburg) move enough traffic to be considered global air transport hubs, a few regional air transport hubs have emerged during the last decade. On the eastern and southern sides of the continent, strong hub-and-spoke structures are centered on Johannesburg and, to a lesser extent, in Nairobi and Addis Ababa. On the western side, no hub-and-spoke structure for continental air traffic can be found, complicating air transportation both within the ECOWAS region and between West Africa and the rest of the continent.

Relative to other regions, ECOWAS has a large domestic air transport market (almost entirely accounted for by Nigeria), but a relatively small market for intra-African air transport (table 2.8). However, the number of international seats is comparatively low—only a third of those found in the SADC region. On average, within ECOWAS, only 8 pairs of domestic cities and 20 international city-

pairs are served. The connectivity is the lowest in Africa after CEMAC (Economic and Monetary Community of Central Africa). The seat-kilometers flown on older aircraft is 43 percent of the total; significantly worse than in other regions of Africa.

Focusing exclusively on the regional air transport market and the patterns of air transport *within* ECOWAS, a hub-and-spoke structure of sorts is more clearly visible. Lagos and Accra are the most prominent hubs, and traffic between these two cities dominates regional air traffic. Abidjan, Bamako, and Dakar constitute a secondary set of hubs, with a significant amount of traffic also flowing between these three cities.

Figure 2.10 International routes within Sub-Saharan Africa for 2007



Source: Bofinger 2009.

Table 2.8 Benchmarking air transport in ECOWAS and other parts of Sub-Saharan Africa

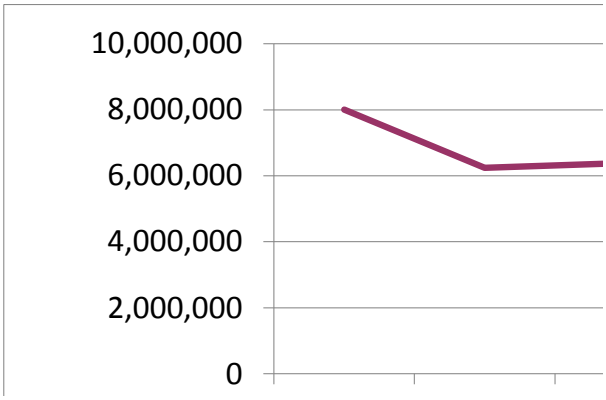
	West Africa	Central Africa	East Africa	Southern Africa
Annual seats, domestic ('000s)	2,034	235	1,345	3,076
Annual seats, international within SSA ('000s)	362	187	1,196	964
Domestic city pairs served (number)	8	4	13	17
International city pairs served (number)	20	15	29	26
Seat-km in old aircraft (% of total)	43	30	33	29
Seat-km in recent aircraft (% of total)	57	70	67	71
Domestic market Herfindahl Index	0.84	0.83	0.64	0.73
International market Herfindahl Index	0.19	0.24	0.25	0.34
Herfindahl Index (domestic and international)	0.21	0.30	0.27	0.42

Source: AICD database.

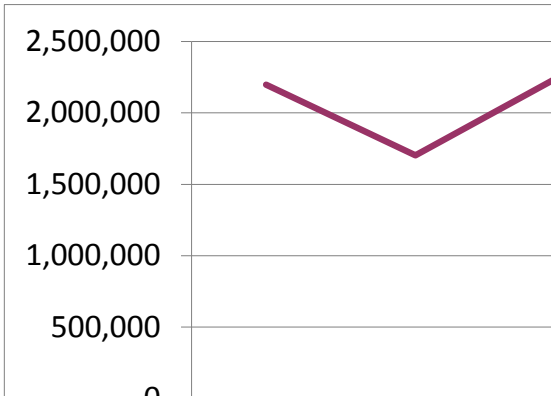
As of 2001, the intraregional air transport market in ECOWAS amounted to about 8 million seats. Capacity declined steeply to just over 6 million seats in 2004, and little if any growth up occurred until 2007 (figure 2.11). That trend masks significant differences across two important subregions. These are the Banjul Accord Group (BAG)—consisting of Cape Verde, Chad, The Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone—and the West African Economic Monetary Union (WAEMU)—comprising Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo. While both subregions have faced similar challenges, they have reacted to them very differently.

Figure 2.11 Seats for intraregional travel within ECOWAS, BAG, and WAEMU countries

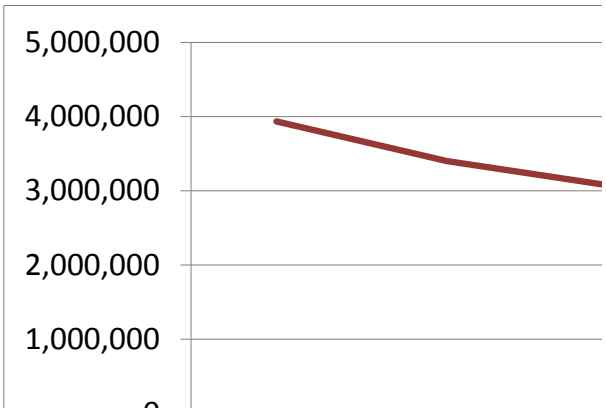
a. ECOWAS



b. Banjul Accord Group



c. West African Economic and Monetary Union



Source: Derived from Bofinger 2009.

The WAEMU countries have sustained a continuing decline in seat capacity since the demise of their main carrier, Air Afrique. In 2001, the WAEMU market was double the size of the BAG market, with some 4 million seats. Air Afrique was the dominant carrier in the subregion, with a capacity of nearly 5 million seats. Following its collapse in 2001 there was a major vacuum in regional air transport capacity, and traffic never recovered, having declined to 3 million seats by 2007 (figure 2.11a).

By contrast, the BAG countries adjusted relatively rapidly to the collapse of their main carrier, Ghana Airways. As a result of their low per capita income and (in several cases) their recent experience of conflict, these countries tend to have relatively thin air traffic per capita, despite their high population densities. Up until 2001, Ghana Airways and, to a lesser extent, Nigeria Airways were dominant in the subregion, providing at least half of seat capacity. Following the collapse of both airlines, air connectivity dipped by about 20 percent between 2001 and 2004 but subsequently rebounded. By 2007 seat capacity had surpassed 2001 levels (figure 2.11b), driven mainly by the growth of Virgin Nigeria, flying between Nigeria and Ghana. In 2007, Virgin Nigeria had about 50 percent of the market in the regional community.

While countries in ECOWAS have fair international connectivity, domestic connectivity is very poor. More than half the countries in ECOWAS have no domestic connectivity at all (table 2.9). In a few cases,

this state of affairs may simply reflect small size (as for The Gambia and Guinea-Bissau), but more generally it reflects low traffic volumes and limited purchasing power in the domestic market. Both of these facts make it difficult for air transport to compete with surface transport alternatives, such as long-distance bus services. Nigeria has the second-largest domestic air market in Sub Saharan Africa, after South Africa, accounting for 11 percent of the overall scheduled domestic traffic.

By and large, each country has at least one daily connection to one of the main regional hubs. What appears to be low connectivity may not be a problem as long as each country has frequent connections to one or more of the main regional hubs. Whether this is so can be assessed by looking at the origin-destination matrix for the ECOWAS countries (table 2.10), which shows that all of the countries in the region indeed have at least seven flights per week to one of the main regional hubs. However, only two countries (Mali and Togo) have as many as two daily flights to their respective hubs. Abidjan is the main hub for Benin, Burkina Faso, Guinea, and Togo. Dakar is the main hub for Cape Verde, Gambia, Guinea-Bissau, and Mali. Accra is the main hub for Liberia and Sierra Leone. While strongly connected to Accra, Lagos is not so strongly connected to the francophone hubs or to any of the other surrounding countries in the region.

Table 2.9 International and domestic connectivity for 2007 (number of city pairs served)

Country	Domestic city pairs	International city pairs	Intercontinental city pairs
Benin	0	19	1
Burkina Faso	1	11	1
Cape Verde	10	5	23
Central African Republic	0	2	1
Côte d'Ivoire	0	23	5
Gambia	0	7	7
Ghana	5	19	9
Guinea	0	8	2
Guinea-Bissau	0	2	1
Liberia	0	8	1
Mali	0	16	1
Niger	0	8	1
Nigeria	22	31	19
Senegal	4	24	18
Sierra Leone	0	8	2
Togo	0	11	1

Source: Derived from Bofinger 2009.

Beyond basic connectivity, it is important to evaluate the convenience and velocity of air travel. For some countries, most of the flights that originate from within the country are direct. To a large extent, flights that orginate from Ghana and Nigeria are direct, because Accra and Lagos are hubs for air travel in West Africa. Senegal is striking in that of the 80 flights that depart, only 59 are direct. On average, flights from Burkina Faso, Guinea Bissau, and Togo cover fewer kilometers per hour than other parts of the subregion (table 2.11).

Table 2.10 All flights from one week in November 2007 for ECOWAS

		Destination														
		Benin	Burkina Faso	Cape Verde	***Côte D'Ivoire***	Gambia	***Ghana***	Guinea	Guinea-Bissau	Liberia	Mali	Niger	***Nigeria***	***Senegal***	Sierra Leone	Togo
Origin	Benin		5		*10*		*5*				1	1	***4***	*3*		4
	Burkina Faso	4			*8*		*3*				9	1		*6*		4
	Cape Verde						*1*							*1*		
	Côte D'Ivoire	*10*	*11*				*22*	*9*		*3*	*8*	*4*	***8***	*14*	*1*	*14*
	Gambia							4		4			***2***	*12*	4	
	Ghana	*1*	*3*	*1*	*23*					*13*			***41***		*9*	*8*
	Guinea				*8*	4				2	1		***2***	*7*		
	Guinea-Bissau			1										*9*		
	Liberia				*3*	5	*9*	2					***3***		3	
	Mali	1	*7*		*4*							3		*18*		
	Niger	1	1		*4*						4			*2*		
	Nigeria	***3***			***8***	***2***	***46***	***2***		***2***				***5***	***4***	
	Senegal	*3*	*6*	*7*	*14*	*11*		*7*	*9*	*1*	*16*	*2*	***5***		*4*	*2*
	Sierra Leone				*1*	5	*7*			6			***3***	*4*		
	Togo	5	4		*15*		*4*						***1***	*2*		

Source: Derived from Bofinger 2009.

ECOWAS's air transport is considered to be among the most liberalized in Africa. In both WAEMU and BAG, the Yamoussoukro decision has reached a high level of implementation—and, in some cases, full implementation. ECOWAS has achieved the most progress in instituting free pricing, lifting capacity and frequency restraints, and allowing airlines to fly so-called fifth-freedom routes (table 2.12)—far ahead of eastern and southern Africa. A concerted policy effort lies behind that achievement, especially in BAG. By the same token, these countries have suffered some of the steepest declines in capacity and traffic. The source of the declines, or near collapse, may be the overcapacity brought about by Air Afrique. However, liberalization is now helping established African carriers, such as Ethiopian Airlines, provide essential connectivity.

The structure of the regional air transport market has changed significantly since 2001, with an overall reduction in market power (table 2.13). As of 2007, the regional air transport market comprised three major carriers—Air Senegal, Virgin Nigeria, and Bellview Airlines—that together account for 44 percent of the regional market. This is a complete turnaround from 2001, when the three major carriers were Air Afrique, Ghana Airways, and SN Brussels, which together accounted for 54 percent of the market. Overall, there has been a slight reduction in market concentration, with the Herfindahl index falling from around 14 to just under 10 percent.

There is also a growing presence in the subregion of major carriers from East Africa. It is noticeable that Ethiopian Airlines and Kenya Airways are taking over some of the routes discontinued after the collapse of Air Afrique and Ghana Airways; as a result, east-west traffic is slowly growing. For example, Ethiopian Airlines' share of the ECOWAS air transport market doubled from 3.4 percent in 2004 to 7.0 percent in 2007. Over the same period, Kenya Airways went from holding 0.2 percent of the market to 5.1 percent.

By contrast, European carriers have largely disappeared. Whereas Air France and SN Brussels together accounted for 12.1 percent of the ECOWAS market in 2001, this share had dwindled to no more than 0.5 percent by 2007. Two reasons may account for the change. As noted, WAEMU and BAG are the most liberalized air zones in Africa, in terms of the Yamoussoukro Declaration. Yamoussoukro, however, applies only to Africa carriers, and to traffic within Africa. This could be giving African carriers the edge. Additionally, the market in ECOWAS is just too thin to entice many European carriers.

Table 2.11 Frequency and velocity of services

	No. of flights per week		Average velocity of trips (kms/hour)
	Direct	All	
Benin	22	28	450
Burkina Faso	22	32	361
Cape Verde	8	9	444
Côte d'Ivoire	70	88	463
Gambia, The	18	27	430
Ghana	91	92	454
Guinea	17	24	425
Guinea-Bissau	9	9	360
Liberia	20	31	431
Mali	38	38	566
Niger	8	10	487
Nigeria	55	65	415
Senegal	59	80	496
Sierra Leone	18	25	549
Togo	17	28	346

Source: Derived from Bofinger 2009.

Table 2.12 Grading of the level of the implementation of the Yamoussoukro Declaration

Community	General status of YD implementation	Status of air services liberalization	Overall implementation score
Arab Maghreb Union	No implementation.	No liberalization within the AMU has been initiated, but the need is recognized.	1
Banjul Accord Group (West Africa)	Principles of the YD agreed upon in a multilateral air services agreement.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open.	4
Economic and Monetary Community of Central Africa.	Principles of the YD agreed upon in an air transport program. Some minor restrictions remain.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open. A maximum of two carriers per state may take part.	5
Common Market for Eastern and Southern Africa	Full liberalization agreed upon ("legal Notice No. 2"), but application and implementation remain pending until a joint competition authority is established.	Pending. Operators will be able to serve any destination (all freedoms), and tariffs and capacity/frequency will be open.	3
East African Community	The EAC council issued a directive to amend bilateral agreements among the EAC states to conform with the YD.	Air services are not liberalized, as the amendment of bilateral agreements is pending.	3
Southern African Development Community	No steps taken toward implementation, although the civil aviation policy includes gradual liberalization of air services within SADC.	No liberalization has been initiated.	2
West African Economic and Monetary Union	The YD is fully implemented.	All freedoms, including cabotage, granted. Tariffs have been liberalized.	5

Only a few countries in ECOWAS have made progress toward achieving international standards in air safety, making this area ripe for further regional collaboration. In some cases, such as Nigeria, problems with air transport safety have been an undesirable consequence of market liberalization. A number of countries (including Senegal, Ghana, Côte d'Ivoire, and Nigeria) have been moving toward achieving international standards in air safety oversight, but the remaining countries in ECOWAS are in need of significant development (figure 2.12). Additionally, only Nigeria and Ghana are equipped with air traffic control and weather information. Further regional cooperation could help to improve oversight and safety, through the pooling of scarce human resources and greater regulatory independence. About half of the ECOWAS member countries already belong to the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), which, with support from France, provides some measure of air traffic safety. There is scope to broaden and deepen such collaborative arrangements.

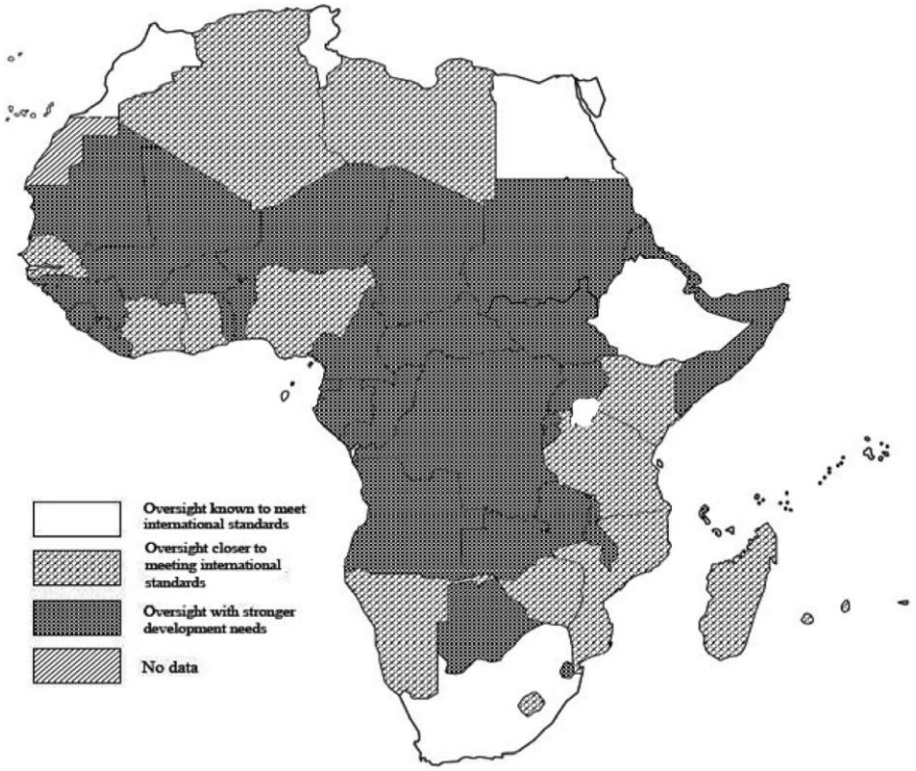
Table 2.13 Evolution of market share of major regional carriers (%)

Airline	Share 2001	Share 2004	Share 2007
Air Senegal International	5.6	20.9	21.8
Virgin Nigeria (replaces Nigerian Airways)			11.5
Bellview Airlines Ltd.	1.7	9.8	10.8
Société Nouvelle Air Ivoire		10.7	8.8
Air Burkina	2.6	9.4	7.5
Slok Air International			7.4
Ethiopian Airlines Enterprise	3.9	3.4	7.0
Kenya Airways	0.1	0.2	5.1
SN Brussels Airlines	7.3		0.3
Air France	4.8		0.2
Air Afrique	32.0		
Ghana Airways Corp.	14.8	15.0	
Cameroon Airlines	1.4	5.4	
Market concentration measures			
Concentration top 3	54.1	41.4	44.1
Herfindahl index	13.8	10.0	9.9

The aging of the West African aircraft fleet is another aspect of the safety issue. In contrast to elsewhere in Africa, the West African fleet has aged significantly between 2001 and 2007. Across Africa, there has been substantial investment in new aircraft, leading to an overall renewal. This is not observed in West Africa, where the percentage of the fleet that is classified as "western old" has increased from 36 to 43 percent between 2001 and 2007 (figure 2.13).

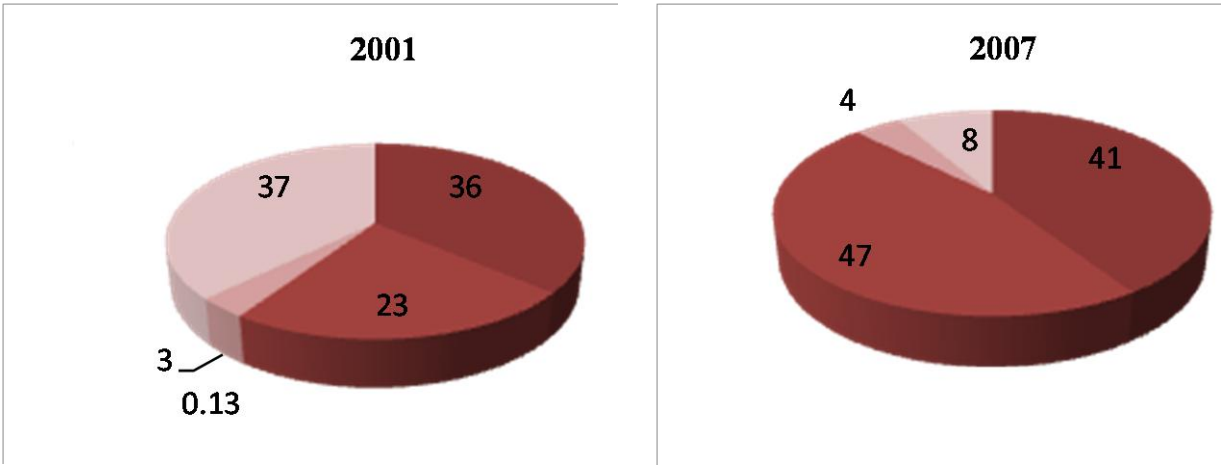
In the ECOWAS region, as well as throughout Africa, the need for new airports is not as great as the need for maintenance and additional capacity at existing facilities. In the case of Dakar, for example, calls for a new airport miss the point that a parallel taxiway could alleviate many of the runway constraints. In addition, a more efficient regional system could be envisioned if Lagos, for example, were turned into a regional hub, with turbo-prop flights into neighboring countries. Any such plans would most likely have to include substantial investment in terminal capacity.

Figure 2.12 Status of African safety oversight, using several criteria



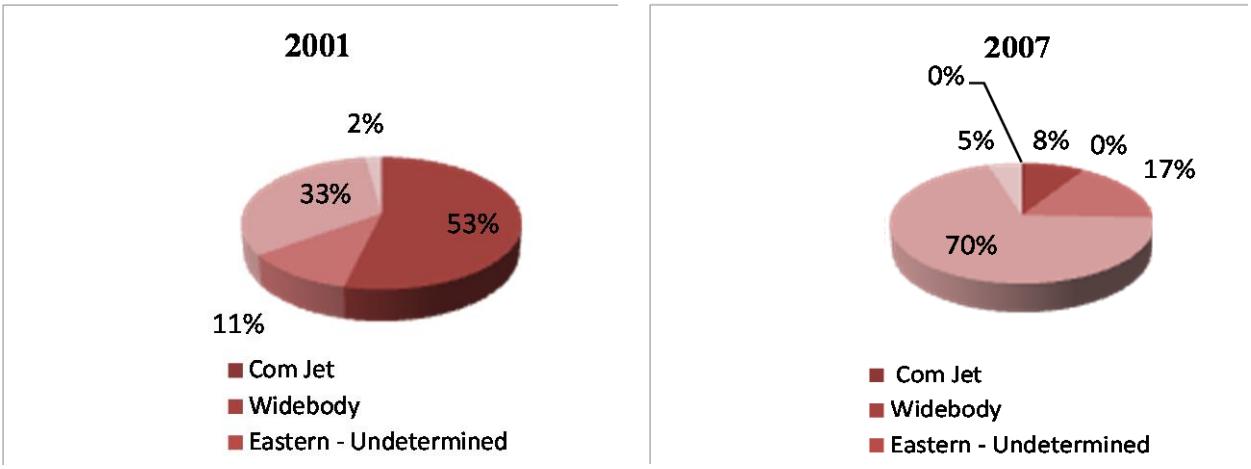
Source: Bofinger 2009.

Figure 2.13 Age distribution of airline fleet in ECOWAS, 2001 and 2007



Source: Derived from Bofinger 2009.

Figure 2.14 Size distribfution of airline fleet in the ECOWAS region

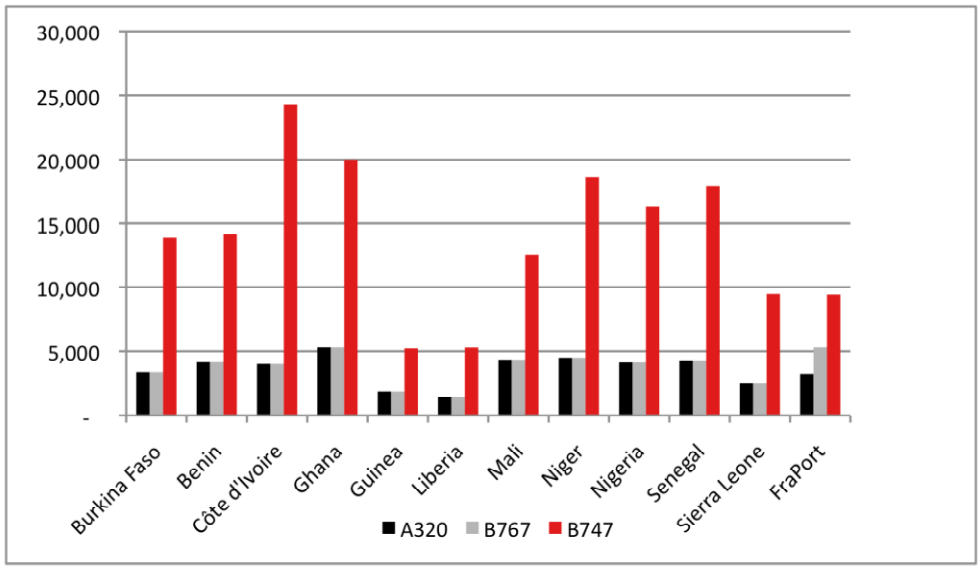


Source: Derived from Bofinger 2009.

ECOWAS needs a central air transport hub that can lift aircraft load factors for regional travel toward sustainable levels. Further rationalization of the air transport market for the region around a single hub, together with a transition toward a smaller fleet of commuter propeller aircraft (such as the Fokker 50 or ATR), could bring significant benefits by increasing the frequency of service to countries with very little traffic. For example, one proposal is for repeating multi-legged flights out of the central hub that could serve several countries in one circular route. This nascent trend is already apparent in the West African aircraft fleet, which has shifted markedly toward Citi jets and commuter propeller planes in recent years (figure 2.14). At present, however, none of the regional airports offers the terminal facilities and equipment needed to act as a hub, and, as noted, significant investments would be needed to make this a reality.

Airport charges in the ECOWAS region are high by international standards. Charges at Fraport in Frankfurt provide a commonly used international benchmark (figure 2.15). As the graph shows, the average charges at African airports are 30 to 40 percent higher than Fraport's charges. After adjusting for the outliers (Cameroon, Côte d'Ivoire, and Ghana), they are 29 percent higher. Anecdotal evidence is now emerging that a number of countries in West Africa are charging much higher passenger fees than others—sometimes in excess of $80 per passenger.

Figure 2.15 Airport charges overall by aircraft type for 18 sample airports

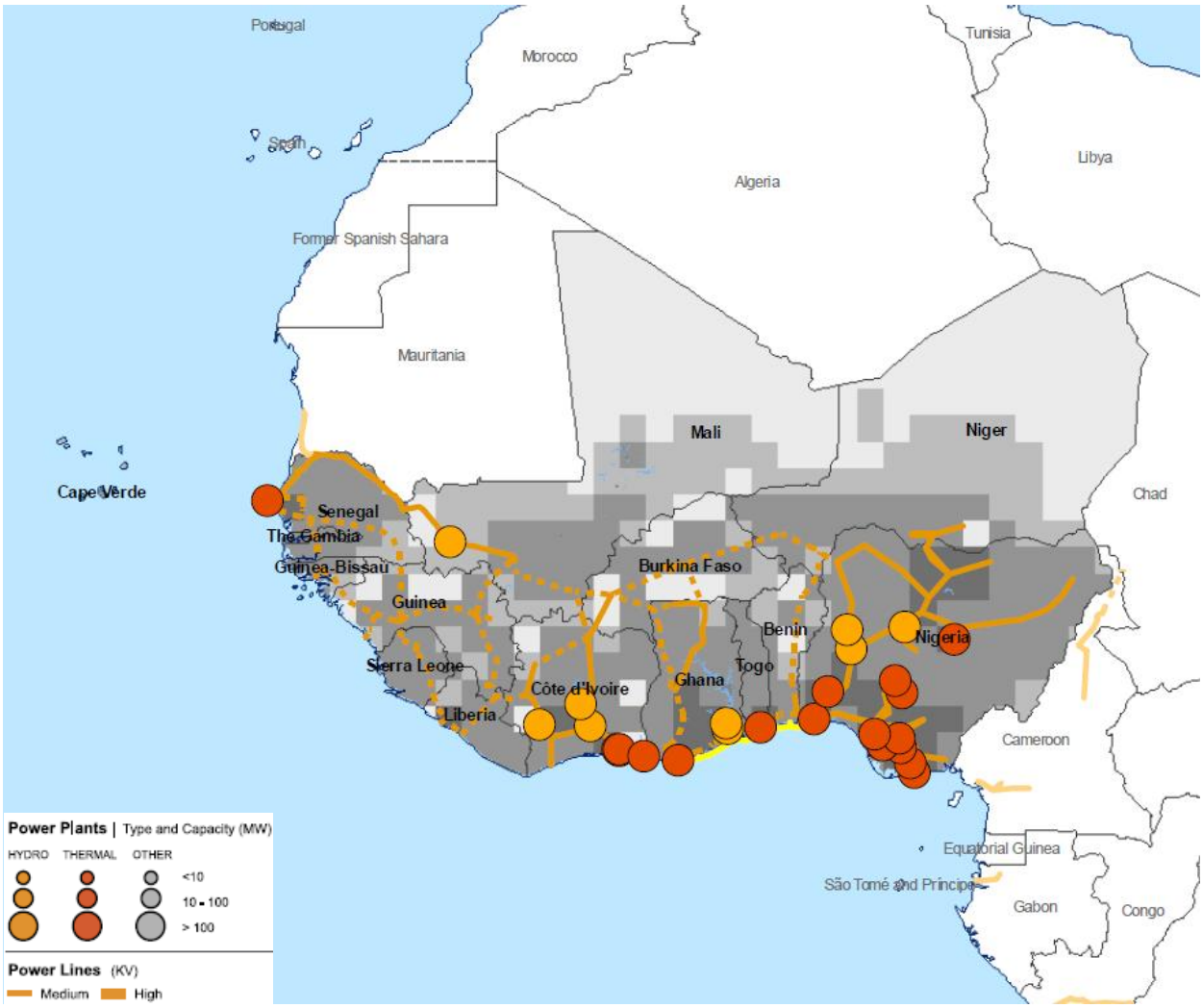


Source: Derived from Bofinger 2009.

Note: Fraport's charges for the Frankfurt am Main airport can be found at the right end. On average, the airports levied charges that were 30 to 40 percent higher than those sampled at Fraport for the same type aircraft.

3 Power

Figure 3.1 ECOWAS's regional power network and infrastructure



Relative to other regional economic communities, ECOWAS performs relatively well in terms of electrification but falls short in terms of generation capacity, service reliability, and utility performance. Access to power stands at 41 percent in the ECOWAS area, substantially higher than that in other subregions. At 50 percent, urban access is as good as the middle-income average for Africa (table 3.1). However, while connections are relatively widespread in the ECOWAS area, the *availability* of power is low. Installed generation capacity per million people is less than a quarter that in the SADC region. Moreover, power supply is very unreliable: Outages are the highest across Africa, leading the private sector to invest widely in backstop generation or absorb serious losses in sales. Overall performance of the region's power utilities leaves plenty of room for improvement. The hidden costs of inefficiency—at

165 percent of sector revenues—are substantially higher than for the other regional economic communities. This is mainly attributable to very low collection rates in ECOWAS, as well as high levels of distribution losses. On a more positive note, the ECOWAS power utilities have the best record of cost recovery of any of the regional economic communities, with power tariffs covering 79 percent of the full capital costs of service provision.

Table 3.1 Benchmarking power infrastructure and capacity, access and utility performance

	ECOWAS	CEMAC	COMESA	EAC	SADC	Low-income countries	Middle-income countries
Installed generation capacity (MW)	3,912	583	1,085	774	9,855	2,110	36,971
Net generation per capita, annual (kWh/capita/year)	171	147	114	82	1214	165	4,479
Outages, number, annually (number/year)	165	152	119	132	91	134	71
Outages, value lost, annually (% of sales)	7	5	7	8	2	5	2
Firms with own generator (% of firms)	54	51	43	56	19	33	18
Access (urban, % of population)	50	31	34	23	35	43	50
Growth in access of population to electricity, annual (%)	2	1	1	1	1	3	2
System losses (% of generation)	29	31	32	23	12		10
Cost recovery ratio, historical (%)	79	45	73	69	68	100	87
Total hidden costs (% of revenue)	159	107	102	65	4	544	0
Collection rate, reported by utility, electricity (% of billing)	71	93	93	94	89		91
	WAPP	CAPP	EAPP	SAPP			
Average historic cost (US$/kWh)	0.21	0.49	0.19	0.14		—	—
Long-run marginal cost (US$/kWh)	0.18	0.09	0.12	0.07		—	—

Source: Eberhard and others 2009.

Note: CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market for Eastern and Southern Africa; EAC = East African Community; SADC = Southern African Development Community.

For the remainder of this section, attention will focus on the countries of the West Africa Power Pool (WAPP). This is because power sector issues in West Africa can be analyzed only in the context of this regional trading arrangement, within which all of the ECOWAS countries except Cape Verde exchange power. Similarly, the benchmarks will be the other regional power pools—the Central Africa Power Pool (CAPP); the East Africa Power Pool, expanded to include important trading partners in the Nile Basin, notably Egypt, Ethiopia, and Sudan (EAPP/NB); and the Southern Africa Power Pool (SAPP).

The baseline total net demand for power in WAPP was 31.3 terra-watt-hours in 2005, making it the third-largest power market in Sub-Saharan Africa behind SAPP and EAPP/NB. Owing to widespread outages, power production meets just 70 percent of existing demands, by far the lowest ratio for any of the regional power pools. Extreme power reliability problems in Nigeria, which is able to meet only 61 percent of its existing demand, pull down the regional average. When Nigeria is excluded, the WAPP countries are meeting 93 percent of existing demand, a fraction much closer to that observed in the other regional power pools.

Power demand within WAPP is expected to triple over the next decade. Taking into account the need to fully satisfy existing demand for power, compounded by the anticipated expansion in market demands driven by economic growth in commerce and industry and the need to provide additional power to support the planned expansion of electrification from 45 percent to 66 percent of households for the region, it is estimated that by 2015 power demand could reach 94.3 terawatt hours, requiring the development of 18,000 MW of new generation capacity—180 percent of existing capacity (table 3.2). These projections are based on economic growth forecasts made before the onset of the global financial crisis of 2008. If the economic crisis halves anticipated economic growth rates in the region, 80 percent of the demand reduction would occur in Nigeria (14.6 TWh) and 14 percent in Ghana.

Table 3.2 Demand and suppressed demand for power in WAPP

All figures are in TWh unless noted otherwise

Country	Total net demand in 2005	Percentage of effective demand met in 2005	Market demand 2015	Social demand with national targets 2015	Total net demand 2015
Benin	0.6	94	0.9	0.8	1.7
Burkina Faso	0.5	98	0.6	0.9	1.5
Côte d'Ivoire	2.9	88	4	1.4	5.4
Gambia	0.1	78	0.2	0.2	0.4
Ghana	5.9	85	10.8	2	12.8
Guinea	0.7	76	1.3	0.8	2.2
Guinea-Bissau	0.1	88	0.1	0.1	0.2
Liberia	0.3	71	0.6	0.7	1.3
Mali	0.4	95	0.6	1.2	1.8
Mauritania	0.2	98	0.5	0.3	0.8
Niger	0.4	98	0.6	0.7	1.2
Nigeria	16.9	61	45.6	13.6	59.2
Senegal	1.5	85	2.5	1	3.5
Sierra Leone	0.2	51	0.5	0.5	1
Togo	0.6	89	0.8	0.7	1.5
WAPP	**31.3**	**70**	**69.6**	**24.8**	**94.3**
SAPP	258.8	99	383	14	396.9
EAPP/NB	100.6	99	144.8	24.2	169
CAPP	10.7	92	17.1	3.1	20.2
Island States	1.1	5	1.6	1.5	3

Source: Rosnes and Vennemo 2009.

Note: The East Africa Power Pool is expanded to include key Nile Basin trading partners Egypt, Ethiopia, and Sudan.

Future power demand can be met either by expanding national production or by expanding cross-border power trade within WAPP. Two alternative scenarios will be considered here. The *trade stagnation* scenario assumes that no additional cross-border interconnectors will be built, so that trade is constrained at the levels observed today and countries will be obliged to meet incremental power demands solely through the development of their domestic power sectors. For many WAPP countries that lack significant energy resources of their own, this entails increased reliance on thermal generation fueled

by oil imports. Alternatively, under the *trade expansion* scenario, future regional power demand is met by the most cost-effective energy resources available to the region as a whole, and additional cross-border transmission capacity is added wherever required to allow power to flow from production to consumption locations. Essentially, this scenario takes regional power trade to its fullest economic potential, assuming that there are no restrictions to cross-border exchange and that the necessary infrastructure can be built wherever it is required. Reality is likely to lie somewhere in between the trade stagnation and trade expansion scenarios, and in this sense the two scenarios serve to frame the range of possible outcomes.

Deepening regional integration would save the WAPP area $435 million in annual energy costs. Table 3.3 compares the cost of meeting growing regional power demand over the next decade, depending on whether the trade stagnation or trade expansion scenario is adopted. Overall, trade expansion reduces the total annual cost of producing and distributing power from $12.7 billion to $12.3 billion, saving the region more than $400 million each year (see below). Under the trade expansion scenario, countries would have to make larger investments in capital-intensive hydropower generation of $162 million each year, as well as invest $117 million a year in the development of cross-border transmission capacity. These higher investments of $279 million a year are more than compensated by reduced variables costs of $714 million a year, essentially the annual reduction in the fuel bill associated with reduced reliance on thermal generating plant. The net savings are hence $435 million each year.

Table 3.3 Annualized costs of system expansion in WAPP, 2015 (US$ millions)

	Trade stagnation	Trade expansion
Generation		
Investment cost	3,365	3,527
Refurbishment cost	258	258
Variable cost (fuel, O&M)	3,442	2,728
T&D and connection		
Investment cost	3,584	3,701
- Cross-border	0	117
- Domestic	3,584	3,584
Refurbishment cost	752	752
Variable cost	1,320	1,320
Total		
Capital cost	7,959	8,238
- Investment cost	6,949	7,228
- Refurbishment cost	1,010	1,010
Variable cost	4,763	4,049
WAPP	***12,722***	***12,287***

Source: Rosnes and Vennemo 2009.

To make trade expansion possible, significant additional investments would be required. In particular, Guinea would need to develop 3,700 megawatts of additional hydropower capacity that would be dedicated to supplying export markets in neighboring countries. Almost all countries in the WAPP region would need to invest significantly in developing a total of 11,250 megawatts of new cross-border interconnectors to allow power to flow more readily around the region (table 3.4). The heaviest transmission investments would have to be made in Côte d'Ivoire, Guinea, and Mali, each of which needs to develop more than 2,000 megawatts of cross-border interconnectors.

The WAPP region as a whole would need to spend about 4.2 percent of its GDP to meet power needs, and most countries stand to save money by deepening regional trade. The spending needs identified in table 3.3 would absorb between 4.2 and 4.4 percent of the WAPP region's GDP, depending on whether the trade stagnation or trade expansion scenario is adopted (figure 3.2). For individual countries, the impact of adopting trade can substantially influence the burden of power sector development needs on their national economies.

Under trade stagnation, seven WAPP countries (The Gambia, Ghana, Guinea-Bissau, Liberia, Senegal, Sierra Leone, and Togo) would need to spend more than 5 percent of their GDP for a decade to meet the region's power sector needs, which is an extremely tall order. And, in the most extreme case, Liberia would need to spend almost 30 percent of its GDP to satisfy power demand.

Under trade expansion, the pattern of spending shifts markedly. Most countries would spend substantially less to meet their power sector needs than under trade stagnation. Only three countries would need to spend significantly more than 5 percent of GDP (The Gambia, Guinea, and Senegal). However, the expenditure burden for Guinea would rise dramatically from around 4 percent of GDP under trade stagnation to more than 20 percent of GDP under trade expansion. This reflects the important role that Guinea would assume as an exporter of hydropower for the region.

Table 3.4 Additional infrastructure requirements for trade expansion (MW)

	Cross-border interconnectors	Additional hydropower
Benin	160	0
Burkina Faso	0	0
Côte d'Ivoire	2,226	0
Gambia	19	0
Ghana	979	0
Guinea	2,283	3,711
Guinea Bissau	818	0
Liberia	258	0
Mali	2,703	0
Mauritania	79	0
Niger	206	0
Nigeria	366	0
Senegal	487	29
Sierra Leone	661	0
Togo	5	18
Total	11,250	3,758

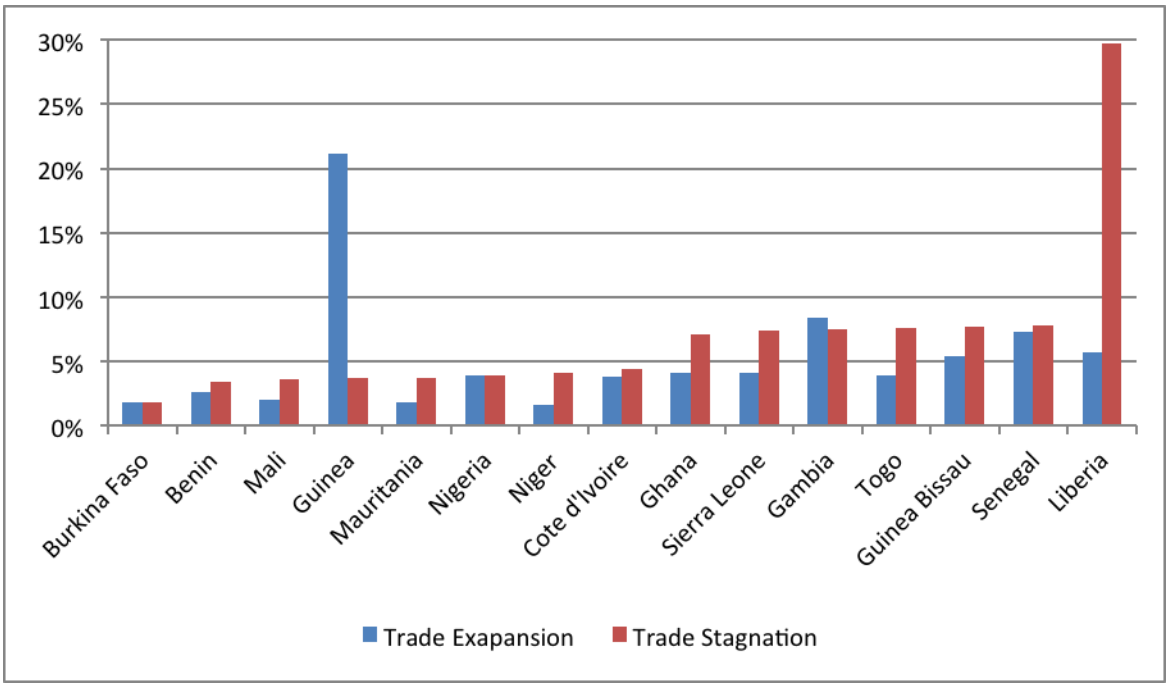
Source: Derived from Rosnes and Vennemo 2009.

In 2005, power trade flows in the WAPP were limited to 5.3 terawatt-hours in total—about 17 percent of demand. Although WAPP is the second most active regional power pool in Africa after SAPP, the volumes of power involved are relatively small. The main flows involve imports by Benin, Togo, and Burkina Faso of power from Côte d'Ivoire and Ghana, while Niger buys from Nigeria (figure 3.3a).

Under trade stagnation, future trade volumes would increase to 15.5 terawatt-hours per year up to 2015, and the pattern of trade would shift somewhat. If future trade is constrained by existing cross-border transmission capacity, the overall volume rises only marginally to 10.2 terawatt hours per year. The most notable change would be the fact that Ghana could switch from being a net exporter to a net importer, leaving Côte d'Ivoire as the main power exporter in the region (figures 3.3b, 3.4b).

Under trade expansion, the volume of power traded within WAPP could increase substantially to 101 terawatt-hours by 2015. The key change under trade expansion is that Guinea would fully develop its hydropower potential and become the major power exporter of the region, sending 17 terawatt-hours annually into neighboring countries and exporting more than five times its domestic consumption (figures 3.3b, 3.4a). As a result, Guinea-Bissau, Liberia, and Sierra Leone, which currently do not import any power, would become significant importers. Mali's imports would also expand considerably. The role of Côte d'Ivoire as a regional power exporter would be substantially reduced, and Ghana would become even more reliant on power imports.

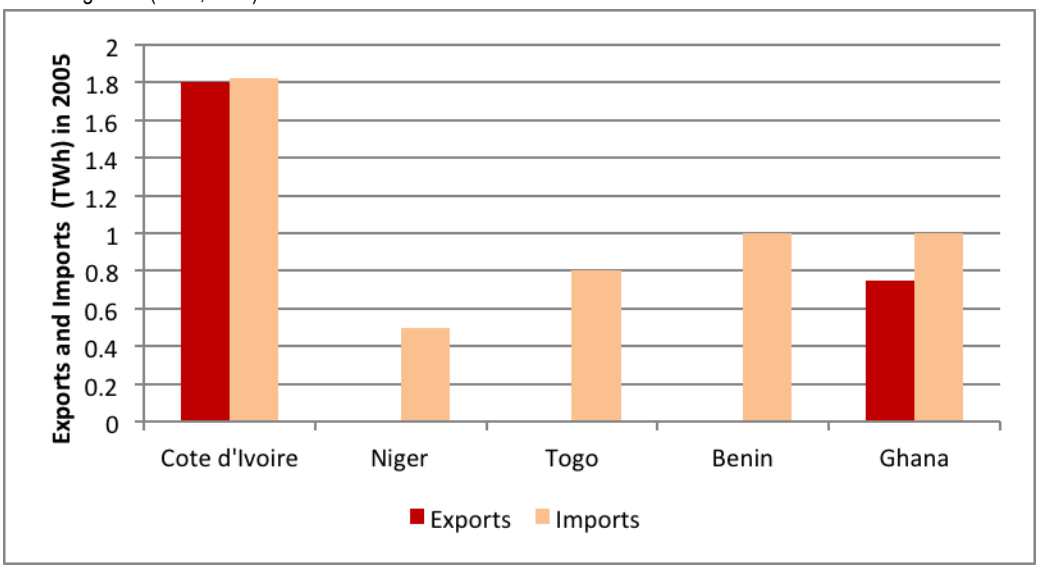
Figure 3.2 Regional spending needs as a percentage of GDP



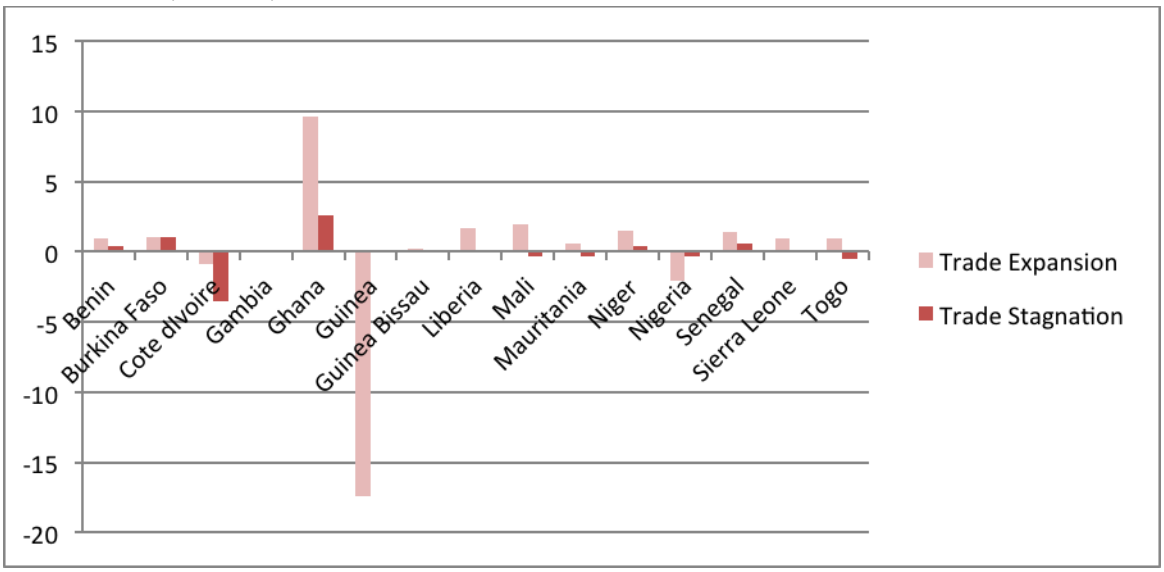
Source: Derived from Rosnes and Vennemo 2009.

Figure 3.3 Existing and simulated patterns of power trade in WAPP

a. Existing flows (2005, TWh)



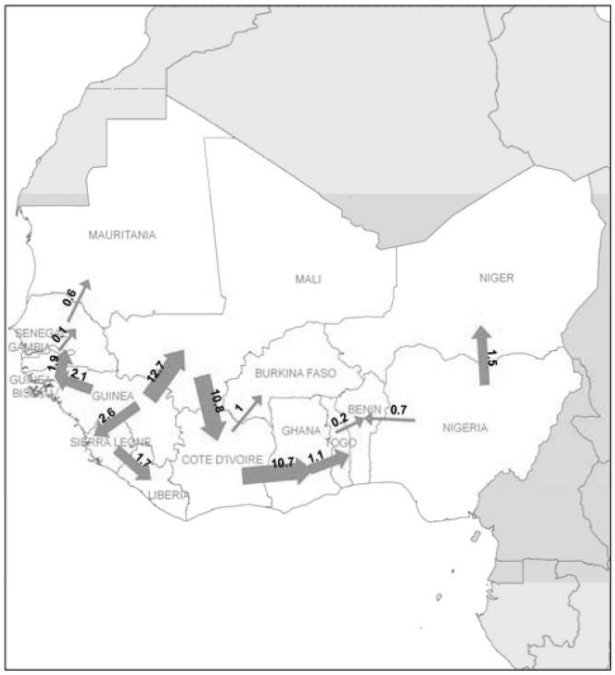
b. Simulated flows (2015, TWh)



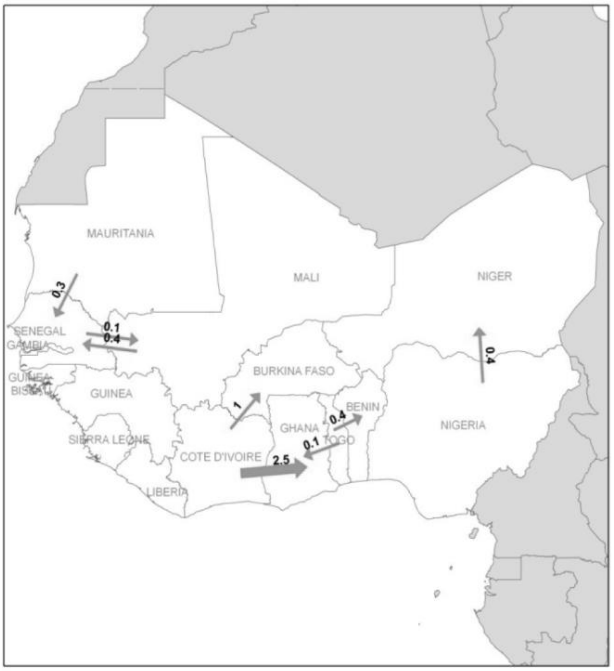
Source: Derived from Rosnes and Vennemo 2009.

Figure 3.4 Trade flows in WAPP in 2015 (TWh)

a. Trade expansion



b. Trade stagnation

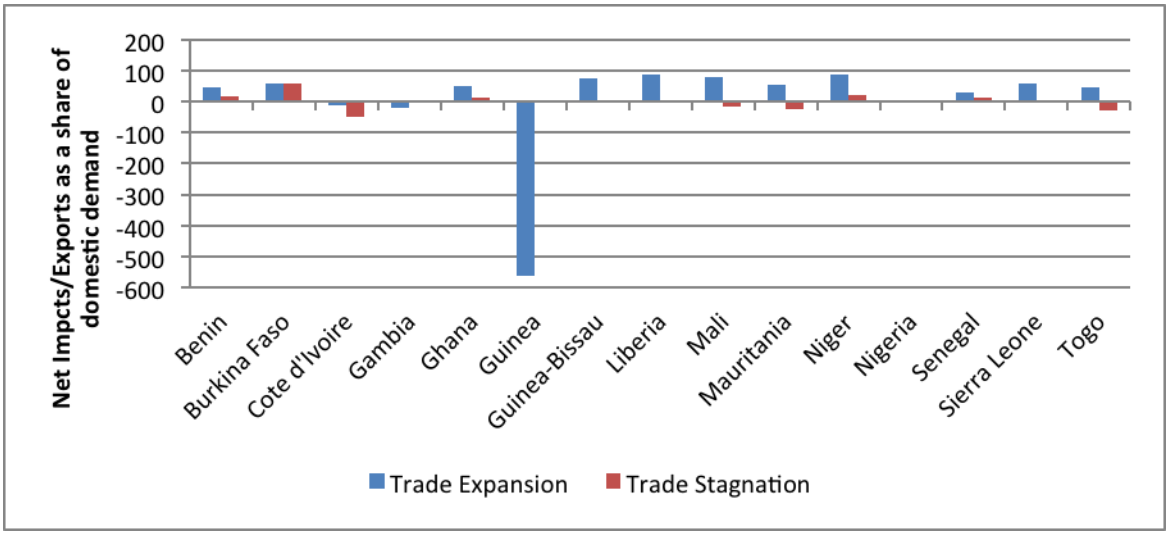


Source: Rosnes and Vennemo 2009.

Under the trade expansion scenario, most WAPP countries would end up importing more than half of their power needs. Figure 3.5 presents the net trade flows between countries under the trade stagnation and trade expansion scenarios. It is evident that under trade expansion most countries become very heavily reliant on power imports to cover much of their power demand. At one extreme, countries such as Guinea-Bissau, Liberia, Mali, and Niger would import more than 80 percent of their power from

neighbors. A second group comprising Burkina Faso, Ghana, Mauritania, Sierra Leone, and Togo would also import a sizable share of their power consumption, ranging between 50 and 100 percent. With the exception of Niger, most of these importing countries would be relying almost exclusively on Guinea for their imports.

Figure 3.5 Net imports as a share of domestic demand (percentage)



Source: Derived from Rosnes and Vennemo 2009.

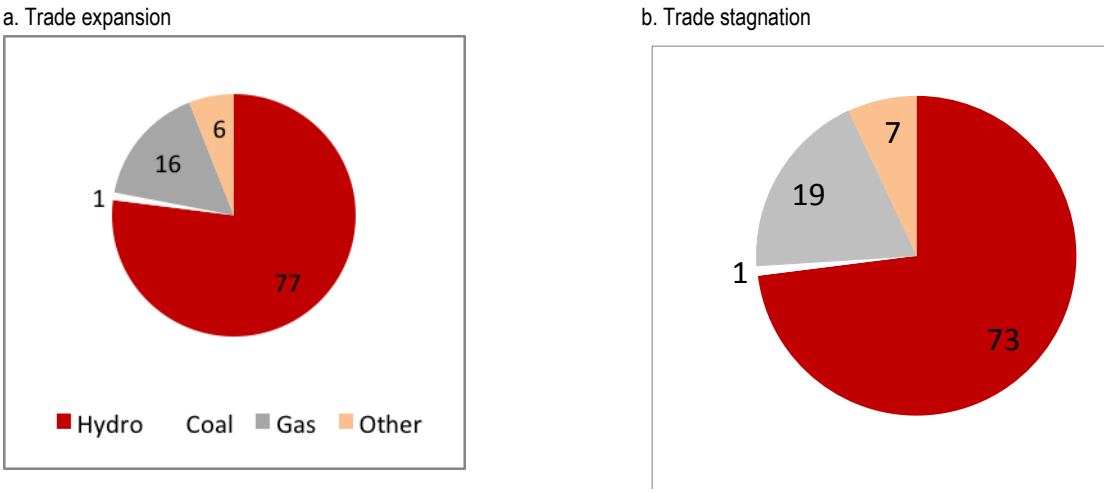
The possibility of accelerating regional power trade in WAPP depends critically on the ability of Guinea to deliver the massive investments in hydropower that would be needed. The implementation of the trade expansion scenario here described essentially hinges on the rapid development of 3,700 megawatts of additional hydropower resources in Guinea. There are a host of technical, financial, and political challenges that make this a difficult prospect. First, from a technical perspective, the envisaged scale-up is more than 30 times Guinea's existing installed generation capacity, which amounts to little more than 100 megawatts—a huge technical challenge for the country. Second, the cost of developing these hydropower schemes would be $786 million annually for a decade, equivalent to almost a quarter of Guinea's GDP, and would not be financially tenable for the country without massive capital contributions from the countries that would ultimately import the power. Third, for many years Guinea has suffered from political instability and weak governance, which do not make it an attractive destination for investments of this magnitude.

In the absence of Guinea's hydropower, regional trade in WAPP would look very different, revolving largely around the role of Côte d'Ivoire. To illustrate the sensitivity of WAPP's trading outcomes to the situation in Guinea, an additional illustrative scenario can be explored, one in which Guinea is unable to develop its hydropower export potential. In this case, Côte d'Ivoire emerges as the major power exporter in the region, and Ghana increases domestic production considerably to reduce net imports. Mauritania and Sierra Leone are also net exporters of power, while Guinea itself becomes a power importer. Relative to the trade expansion scenario, annualized power system costs in WAPP increase by only 3 percent as the balance of costs shifts away from investment and toward operational expenditures.

It is striking that under almost any scenario, Nigeria—by far the largest power producer and consumer in the region—hardly participates in the trading process. Nigeria already accounts for 53 percent of all power consumption in the WAPP region, and this share is projected to increase to 65 percent by 2015. Notwithstanding Nigeria's weight in the region as a whole, the economics of power trade in WAPP are such that Nigeria does not emerge either as a major importer or exporter of power under any trading scenario, but simply retains its role as a supplier of Niger and possibly begins to export modest amounts of power to Benin. Essentially, Nigeria seems to have a clear comparative advantage in meeting its own domestic power needs through its own hydropower and natural gas resources and would not find it attractive to import power from neighboring WAPP countries under any of the scenarios that can be envisaged. This is in contrast to other power pools, such as SAPP and EAPP/NB, where the major power consumer in each region—South Africa and the Arab Republic of Egypt respectively—acts as a major importer of power and anchor client for overall regional trading arrangements.

By increasing the hydropower share in the regional generation portfolio, the trade expansion scenario would lead to annual savings in emissions of some five million tonnes of carbon. The main impact of trade expansion would be to make possible a shift away from thermal generation and relatively dispersed small-scale hydropower, toward larger and more cost-effective hydropower resources. Overall, the weight of hydropower in the regional generation portfolio would increase from 73 to 77 percent, with natural gas (and to a lesser extent diesel) being displaced (figure 3.6). Some 11.5 terawatt-hours of additional hydropower generation would take place, thereby reducing carbon emissions by 5.2 million tons (table 3.5). The savings in carbon emissions, although not insignificant, are low compared to those that would be possible in other regional power pools, where trade would permit a much larger volume of hydropower to be harnessed.

Figure 3.6 Power generation mix



Source: Derived from Rosnes and Vennemo 2009.

Beyond the financial savings reported above, deepening regional power trade would bring substantial economic benefits to the region by reducing the long-run marginal cost of power by 5 percent overall. Given that power is a key production input to the economy, any reduction in this reference level of power costs will have an important knock-on effect in terms of productivity

and competitiveness. For WAPP as a whole, trade expansion would reduce the long-run marginal cost of power from $0.19 to $0.18 per kilowatt-hour, a reduction of 5 percent.

Table 3.5 Differences in electricity production and CO2 emissions under power trade scenarios

	WAPP	SAPP	EAPP	CAPP	Total	WAPP	SAPP	EAPP	CAPP	Total
	Production difference (TWh)					*Emissions savings (millions of tonnes)*				
Coal		–41.5	0.7		–40.8		–37.8	0.6		–37.2
Diesel	–0.8	–0.3	0.3		–0.8	–0.6	–0.2	0.2		–0.6
Gas	–9.2	–5.3	–42.4		–56.8	–4.7	–2.7	–21.5		–28.9
HFO	0.2		0.4	–4.9	–4.3	0.1		0.3	–3.6	–3.2
Hydro	11.5	47.5	43.4	5.1	107					0
Total	**1.6**	**0.5**	**2.4**	**0.3**	**4.7**	**–5.2**	**–40.7**	**–20.4**	**–3.6**	**–69.9**

It should be noted that with or without trade, the economic cost of power in West Africa remains by far the highest in Sub-Saharan Africa. Moreover, the benefits of power trade in the region, though significant, are not as large as those found in the CAPP and SAPP areas (table 3.5).

The magnitude of power cost savings varies hugely across individual countries in the WAPP area (table 3.6). Small countries that have traditionally relied on very expensive small-scale oil-based generation would gain the most if they were able to import hydropower from Guinea. In particular, countries such as Guinea-Bissau, Liberia, Mali, and Niger could save between $0.03 and $0.07 per kilowatt-hour, a percentage reduction in power costs of between11 and 44 percent. Even in countries where savings appear more modest—on the order of $0.01 per kilowatt-hour—the aggregate value of these savings can be quite significant. Finally, Guinea the major power exporter under trade expansion, would face an increase in long-run marginal costs due to the need to develop a much larger amount of power, and hence more expensive schemes than those that would be strictly necessary to meet domestic demands alone.

Table 3.6 Long-run marginal costs of power in WAPP

US cents/kWh	Trade expansion	Trade stagnation	Absolute differential	Gain in LRMC due to trade (%)
CAPP	7	9	–2	–22
EAPP	12	12	0	0
SAPP	6	7	–1	–14
WAPP	**18**	**19**	**–1**	–5
Benin	19	19	0	0
Burkina Faso	25	26	–1	–4
Côte d'Ivoire	15	15	0	0
Gambia	8	7	1	14
Ghana	10	10	0	0
Guinea	7	6	1	17
Guinea-Bissau	9	16	–7	–44
Liberia	8	14	–6	–43
Mali	25	28	–3	–11
Mauritania	14	15	–1	–7
Niger	25	30	–5	–17
Nigeria	13	13	0	0
Senegal	43	47	–4	–9
Sierra Leone	9	10	–1	–10
Togo	10	11	–1	–9

Source: Rosnes and Vennemo 2009.

The overall rate of return on power trade for power exporters in WAPP is 18 percent; for importers, 1 percent. For the WAPP exporters as a whole, regional power trade represents a gain of 18 percent annually for a one-time investment of $8.1 billion over 10 years in interconnection and additional hydropower capacity. For importers, a one-time investment of $580 million over a decade produces a return of 1 percent annually (table 3.7). The overall rate of return on the investment for WAPP as a whole is 33 percent. While this is a good rate of return, it is substantially lower than the returns to trade in other power pools, notably SAPP, which stands to make a return of 168 percent on power trade due to the exceptionally cost-effective hydropower resources available in Democratic Republic of Congo.

Table 3.7 Rate of return to power trade at country level

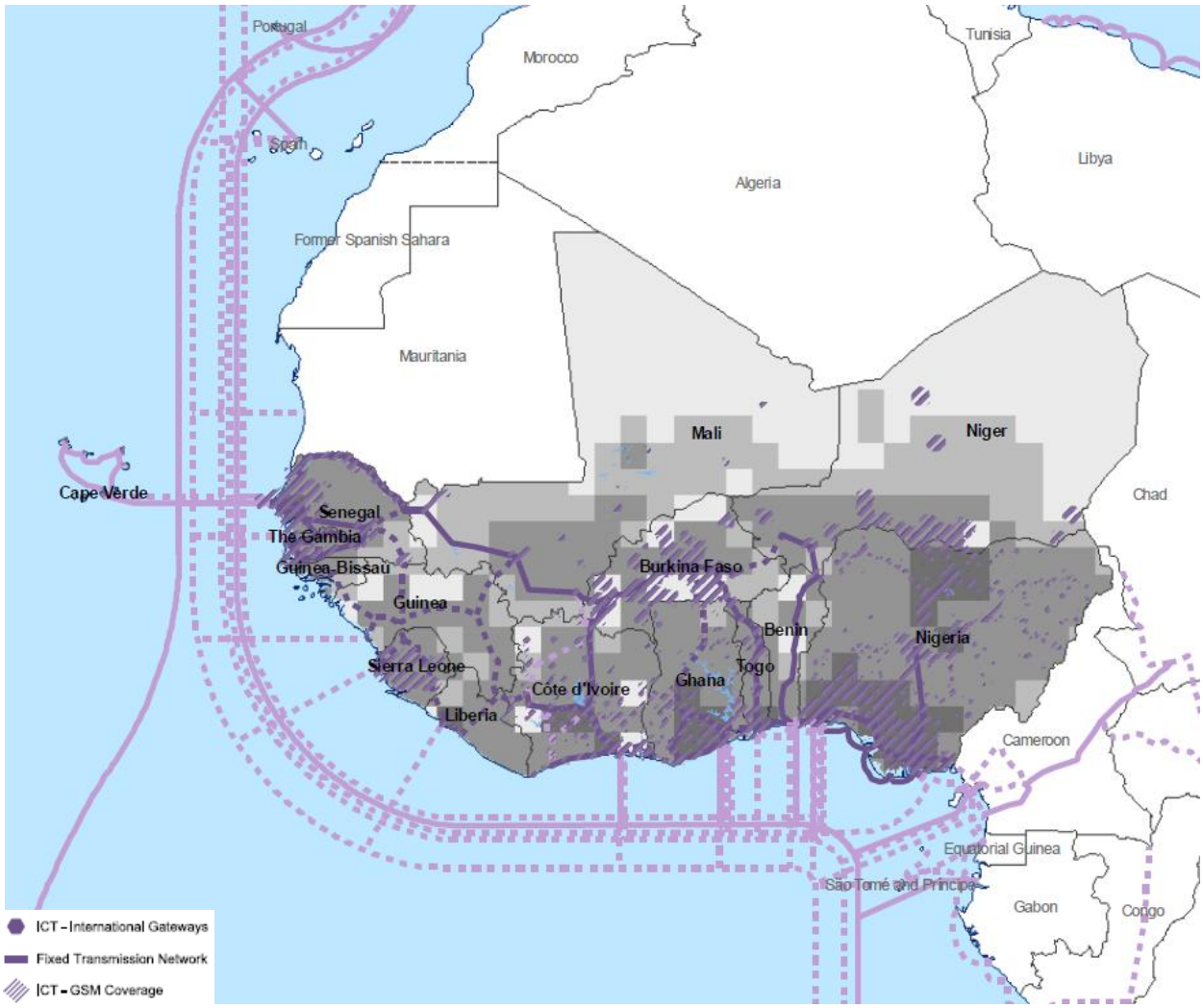
Country	Price gain (US$/kWh)	Net power trade (TWh)	Annual benefits (US$ millions)	One-time investment (US$m)	Rate of return (%)
Exporters					
Côte d' Ivoire	0.06	0.9	64.8	270	24
Guinea	0.05	17.4	1,044	7,860	13
Importers					
Burkina Faso	0.01	1.5	15	0	n.a.
Togo	0.01	1.5	15	0	n.a.
Niger	0.05	1.2	60	0	n.a.
Benin	< 0.01	1.7	0	0	n.a.
Ghana	< 0.01	12.8	0	50	n.a.
Mauritania	0.01	0.8	8	100	8
Sierra Leone	0.01	1	10	70	14
Mali	0.03	1.8	54	260	21
Guinea Bissau	0.07	0.2	14	50	28
Liberia	0.06	1.3	78	20	390
Senegal	0.04	3.5	140	30	467
WAPP (exporters)		20.4	1462	8150	18
WAPP (importers)		27.3	394	580	1

Source: AICD calculations.
Note: n.a. = not applicable.

Individual countries stand to make higher returns. For power importers, the trading decision can be thought of as an investment in cross-border interconnection that yields an annual return in terms of access to lower-cost power. On this basis, it is possible to calculate returns to trade for individual importers. Burkina Faso and Togo stand to make exceptionally high returns, while Liberia, Niger, and Senegal make a solid 30 percent return on such investments. Returns for other importers are much lower due to the high cost of interconnectors. For power exporters, the trading decision can be thought of as an investment in additional generation capacity and cross-border interconnection that yields an annual return in terms of revenues from power export. For example, Guinea could expect to make annual export revenues of $1.4 billion on a one-time investment of $7.9 billion, yielding a rate of return of 19 percent.

4 Information and communication technologies

Figure 4.1 ECOWAS's regional ICT network



Source: AICD.

Compared with other regional economic communities, ECOWAS performs relatively well on access to information and communication technology but faces relatively high prices for critical ICT services. International bandwidth, at 16 bits per capita, and mobile subscriptions, at 25 per 100 inhabitants, are the second-highest in Sub-Saharan Africa after the Southern African Development Community (SADC). Overall, however, broadband access rates and Internet subscriptions in ECOWAS are very low compared with SADC. High tariffs may provide part of the explanation for that difference. At $14, the price of a monthly prepaid mobile basket is higher than in any other region except CEMAC, while the average price for monthly Internet access, at $80, is exceeded only by EAC. On the other hand, prices of international telephone calls and fixed-line telephone service are relatively low (table 4.1).

Table 4.1 Benchmarking ICT infrastructure across regional communities

	ECOWAS	CEMAC	COMESA	EAC	SADC
Broadband subscribers (per 100 inhabitants)	0.03	0.01	0.04	0.02	0.36
International Internet bandwidth (per capita)	16	11	9	11	19
Internet subscribers (per 100 inhabitants)	0.24	0.06	0.09	0.05	0.53
Main telephone lines outside largest city (per 100 inhabitants)	0.39	0.20	0.53	0.24	1.89
Mobile telephone subscribers (per 100 inhabitants)	25	22	12	21	31
Prepaid mobile price basket (US$ per month)	14.04	15.11	9.09	12.18	11.32
Price of a three-minute call to United States (US$)	0.83	5.68	2.20	1.37	1.50
Price of 20-hour Internet basket (US$ per month)	79.98	67.97	50.91	95.70	75.60
Price of fixed telephone price basket (US$ per month)	9.35	12.59	6.85	13.33	13.27

Source: Ampah and others 2009.

Note: CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market for Eastern and Southern Africa; EAC = East African Community; SADC = Southern African Development Community.

ICT access and prices at the regional level mask significant variations (table 4.2). Broadly speaking there are two groups of countries within the ECOWAS area. The first group—comprising Cape Verde, Côte d'Ivoire, Ghana, Nigeria, and Senegal—have relatively high mobile penetration (generally in excess of 30 subscribers per 100 population), mobile footprint (generally in excess of 70 percent of the population), and international bandwidth (generally above 40 bits per capita). A second group—comprising the remaining countries—has substantially worse access indicators across the board, with mobile penetration generally below 20, a mobile footprint generally below 60 percent of the population, and international bandwidth generally below 20 bits per capita. Pricing structures also vary substantially, though not systematically across the two groups, with the price of a prepaid monthly basket varying from $4 in Guinea to $20 in Sierra Leone.

As far as fixed-line international calls are concerned, it is somewhat cheaper to call within ECOWAS than to other parts of Africa, but still expensive in absolute terms. International fixed-line calls within ECOWAS, at around $0.73 per minute, are much cheaper than calls from ECOWAS member states to other countries in Sub-Saharan Africa (around $0.92 per minute) (figure 4.2), except in the Economic Community of Central African States (ECCAS).[4] Nevertheless, the range is huge, with an intra-ECOWAS call costing around $ 0.26 in Côte d'Ivoire and $1.20 in Cape Verde, which is geographically isolated from the rest of the ECOWAS members. In Côte d'Ivoire and Ghana, it is cheaper to call the United States than it is to call within the community. Ghanaians pay about $0.12 per minute to call the United States—the lowest such rate in the region; but to call another ECOWAS member state they pay three times more than their neighbors.

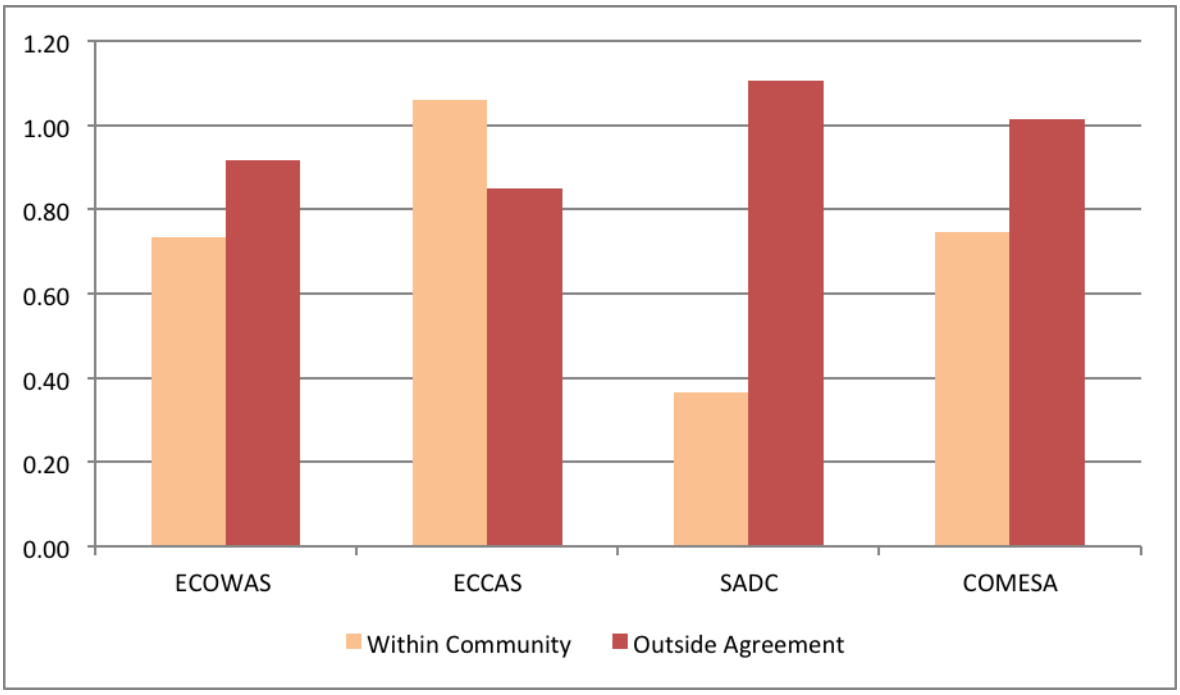
[4] The member states of ECCAS are Angola, Burundi, Cameroon, Chad, Democratic Republic of Congo, Republic of Congo, Central African Republic, Equatorial Guinea, Gabon, and Democratic Republic of São Tomé and Príncipe. A subgroup of these countries forms the CEMAC (Economic Community of Central African States) countries, composed of Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon.

Table 4.2 Benchmarking ICT infrastructure within ECOWAS

Access	Benin	Burkina Faso	Cape Verde	Côte d'Ivoire	Gambia,	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Broadband subscribers (per 100 inhabitants)	0.02	0.01	0.78	0.11	0.02	0.06	0.00	0.00	0.00	0.03	0.00	0.00	0.34	0.00	0.08
Coverage of mobile network (% of population)	43.0	60.3	80.8	57.2	60.0	73.0	40.0	60.0	40.0	40.0	45.0	71.0	85.0	73.0	80.0
International Internet bandwidth (per capita)	17.2	16.4	49.5	42.0	19.9	21.2	0.3	1.2	0.1	12.2	2.4	4.6	151.7	0.1	28.1
Internet subscribers (per 100 inhabitants)	0.10	0.14	1.54	0.08	0.28	0.15	0.13	0.04		0.13	0.03	0.34	0.28	0.02	0.26
Mobile telephone subscribers (per 100 inhabitants)	20.1	10.9	31.0	36.6	33.4	32.4	14.6	19.2	15.0	20.5	6.3	26.5	36.8	13.2	18.1
Price of a three-minute call to United States (US$)	1.06	1.22	3.61	0.91	1.85	0.44	4.61			1.73	1.93	0.28	1.03		2.43
Price of the fixed-line monthly phone basket (US$)	5.34	12.00	8.02	25.02	4.00	6.33	7.10			11.01	12.64	7.39	10.48	2.11	13.86
Prepaid mobile monthly basket (US$)	10.4	15.5	12.9	12.9	6.9	5.7	3.8	11.3		14.7	15.0	16.3	9.1	19.4	16.0
Price of 20- hour Internet basket (US$)	43.1	75.0	44.2	47.8	17.8	9.4	26.8	74.9		28.4	51.2	118.9	25.8	9.9	20.3

Source: Ampah and others 2009.

Figure 4.2 Price of one-minute peak-rate call within and outside regional community (US$)



Source: Ampah and others 2009.

Note: ECCAS = Economic Community of Central African States; COMESA = Common Market for Eastern and Southern Africa; SADC = Southern African Development Community.

Perhaps more relevant than fixed-line international calls are regional roaming arrangements for mobile services—and this is an area where ECOWAS is relatively advanced. Given that fixed-line services have largely been overtaken by mobile services in West Africa, the regional availability of roaming arrangements on mobile tariffs is in many ways a more relevant measure of the cost of internal communications. Compared to other regional communities, ECOWAS has made significant progress in promoting roaming through special intra-operator arrangements. Subscribers who belong to one of these networks can use their mobile handset in the other countries, where they do not pay for incoming calls and are charged local rates for outgoing calls. Prepaid users can also add time to their phones in the country in which they are roaming. Subscribers who do not belong to specific networks can still use their mobile phones in other ECOWAS countries as long as there is a roaming agreement with the operator in the country in which they are roaming. However, they will not benefit from the preferential tariff rates and features of the interoperator roaming schemes, and hence will have to pay to receive incoming calls and pay a surcharge on outgoing calls. Some operators offer roaming only for postpaid subscribers. Only Côte d'Ivoire and Senegal have roaming agreements with every ECOWAS country. Cape Verde has the fewest roaming agreements within the region, a reflection of its geographical and linguistic isolation (table 4.3).

Table 4.3 GSM roaming in ECOWAS

To > / From ⬇	Benin	Burkina Faso	Cape Verde	Côte d'Ivoire	Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Benin		*		■	*	■	■	■	■	*	*	■	*	*	*
Burkina Faso	*		*	*	*	⊙		*	*	*	⊙	⊙	*	⊙	*
Cape Verde	PO	PO		PO	PO	PO				PO	PO	PO	PO		PO
Côte d'Ivoire	■	●	●		●	●	■	■	■	●	●	●	●	●	●
Gambia	PO	PO	PO	PO		PO			PO	PO	PO	PO	PO	PO	PO
Ghana	■	⊙		■	PP		■	■	■	PP	⊙	⊙	PP	⊙	PP
Guinea	■	*		■	*	■		■	■	●	●	■	●	*	
Guinea-Bissau	■		*	■	*	■	■		■	●	●	■	●		
Liberia	■			■	*	■	■	■				■			
Mali	PP	PP		●	PP	PP	●	●			●	PO	●	PO	PP
Niger	*	⊙		●	*	⊙	●	●		●		⊙	●	⊙	
Nigeria	■	⊙		■	PO	⊙	■	■	■	PO	⊙		PO	⊙	PO
Senegal	PP	PP	PO	●	PP	PO	●	●	PO	●	●	PP		PO	PP
Sierra Leone	*	⊙	*	*	*	⊙	*		*	*	⊙	*	*		*
Togo	PO	PO		PO		PO				PO		PO	PO		

ONE (Zain) ⊙		⊙				⊙					⊙	⊙			
Orange Zone ●				●			●	●		●	●		●		
One World (MTN) ■	■			■		■	■	■	■			■			

Note: * Not specified if postpaid only. PO=Postpaid only. PP=Prepaid and postpaid.
Source: Derived from Ampah and others 2009.

Two factors explain the relatively advanced state of regional integration with regard to mobile roaming arrangements. One is the existence of a proactive regional regulatory association for ICT. The other is the existence of a number of large mobile operators with presence across multiple ECOWAS countries.

ECOWAS and its regional telecom regulator have been particularly active in promoting regulatory harmonization of the ICT sector. Through a commissioner for infrastructure and a Department of Transport and Telecommunications, ECOWAS promotes key objectives in the telecommunications sector, such as establishing a single liberalized market, harmonizing laws and regulations, coordinating and integrating regional infrastructure projects, and enhancing GSM in the region. The national members of the West Africa Telecommunications Regulators Association (WATRA) communicate regularly to keep abreast of telecom issues in the region and share information. The existence of this relatively developed institutional structure has helped to facilitate the roaming arrangements that are observed in the region.

Several large mobile groups with a multicountry presence dominate the regional telecommunications market. Across the board, ECOWAS member states have been very open to foreign investment in mobile telecommunications, with most countries having two or three foreign operators (table 4.4). In particular, seven major mobile operators—Etisalat, France Telecom, Maroc Telecom, Millicom, MTC (Zain), MTN, and Comium—have established a significant presence in the region, each covering between two and seven countries. Both France Telecom and French Vivendi channel their West African investments through local subsidiaries (Sonatel of Senegal and Maroc Telecom respectively), with the public-service philosophy of the subsidiaries sometimes guiding strategy and policy. These multicountry networks underpin the regional roaming arrangements detailed above, which essentially collapse into three roaming areas: Orange Zone, Zain One, and One World (table 4.5).

Table 4.4 Foreign investors in the ECOWAS telecom sector (percentage of shares held and numbers of operators)

Country	Etisalat (UAE)	France Telecom	Maroc Telecom	Millicom (Luxembourg)	MTC (Zain,) (Kuwait)	MTN (South Africa)	Comium (Lebanon)	Other	TOTAL	Other note
Benin	51%					75%		1	3	Globacom (Nigeria)
Burkina Faso	51%		51%		100%				3	
Cape Verde								2	2	Portugal Telecom (40%) Teylium (Côte d'Ivoire) (70%)
Côte d'Ivoire	—	85%				65%	—	1	5	Warid (UAE)
Gambia							—		3	Other=Lintel (Lebanon, 100%)
Ghana				100%	75%	98%		2	5	Globacom (Nigeria) Vodafone (UK) (70%)
Guinea		38%				75%		2	4	Teylium (Côte d'Ivoire) Cellcom (U.S.)
Guinea Bissau		42%				100%			2	
Liberia						60%	—	1	3	Cellcom (U.S.)
Mali		30%	51%						2	
Niger	57%	80%			90%			—	4	Other=ZTE (China) and LAP (Libya)
Nigeria	40%				66%	76%			3	
Senegal		42%		100%					3	Sudatel (Sudan) (100%)
Sierra Leone					100%		—	—	2	Other: Lintel (Lebanon, 100%)
Togo	—								1	
TOTAL	6	6	2	2	5	7	4			

Source: Derived from Ampah and others 2009.

— = Data not available.

Table 4.5 Regional roaming networks within ECOWAS

Network	Countries
Orange Zone	Available for subscribers in Côte d'Ivoire, Guinea, Guinea-Bissau, Mali, Niger, and Senegal
Zain One	Available for subscribers in Burkina Faso, Ghana, Niger, Nigeria, and Sierra Leone
One World of MTN	Available for subscribers in Benin, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, and Nigeria.

Source: Derived from Ampah and others 2009.

ECOWAS has several submarine fiber optic cables. The main international cable in the region is the South Atlantic 3 (SAT-3)/WASC, which extends from Malaysia to South Africa and then up the West Coast of Africa to Portugal and Spain. In addition, the Atlantis-2 cable runs from South America to Cape Verde and Senegal and then up to Portugal and Spain. The 9,800-kilometer Glo-1 cable was launched in September 2009 with a landing station in Nigeria. It will connect several other West African countries with onward extensions to London and New York.[5]

Several additional undersea cables are planned, so that by the year 2012 West Africa will likely be served by at least five submarine cables (4.3). For example, the planned Africa Coast to Europe (ACE) cable,[6] which will run from France to Gabon, is expected to be operational by 2011. Seventeen operators signed the memorandum of understanding in November 2008. ACE will connect all countries along the west coast of Africa, from Morocco to South Africa (more than 25 countries in Africa and Western Europe).[7] The 14,000-kilometer Main One cable system is expected to connect Africa with Europe, the Americas, and Asia in 2010. The initial deployment will connect Portugal to Nigeria, with a landing station in Ghana. After this is complete, the network will be expanded to connect South Africa, Angola, Gabon, Senegal, Democratic Republic of Congo, Côte d'Ivoire, and Morocco.[8] The West African Cable System (WACS) will link Europe, West Africa and South Africa. The WACS consortium has 11 operators from 9 countries.[9]

Nevertheless, quite a few countries are unconnected to the submarine cables, and the intraregional backbone remains incomplete. At present, only five coastal ECOWAS countries have landing stations for SAT3—Benin, Côte d'Ivoire, Ghana, Nigeria, and Senegal. The other coastal countries are completely bypassed at present. Guinea, Liberia, and Sierra Leone lack terrestrial fiber optic connections with the regional network that might provide at least some form of indirect access. The landlocked countries also remain unconnected, although new infrastructure is already underway. The planned ACE cable includes landing stations for the Gambia, Guinea, Liberia, Mauritania, Sierra Leone, and Togo. In addition, it will increase competition in the countries that already have access to submarine infrastructure by providing an alternative route for traffic.

[5] http://allafrica.com/stories/200909071164.html

[6] http://www.orange.com/en_EN/press/press_releases/cp090609en.jsp

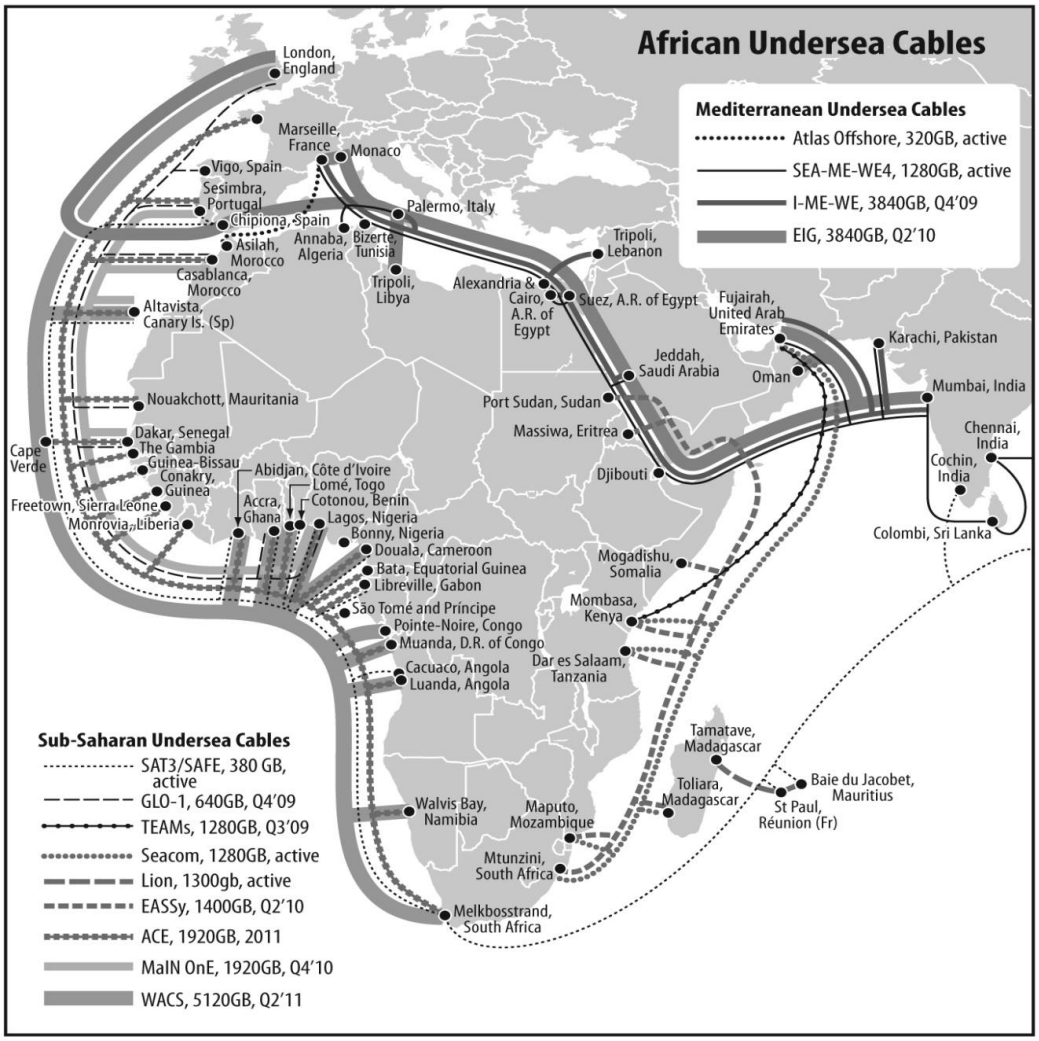
[7] http://www.orange.com/en_EN/press/press_releases/cp090609en.jsp

[8] http://www.mainonecable.com

[9] http://allafrica.com/stories/200910270242.html

The European Union is funding an ECOWAS study of the feasibility of developing regional backbones to connect the region's fragile and postconflict countries (Guinea, Guinea Bissau, Liberia, and Sierra Leone) to the SAT3/WASC submarine cable network. Another regional connectivity project aims to leverage the unused fiber optic installed in electric utility power lines. That project is ongoing in collaboration with the West Africa Power Pool and the association of the region's electrical utilities.

Figure 4.3 Proposed fiber optic connectivity in ECOWAS



Source: Mayer and others 2009.

Even where submarine connections exist, costs remain relatively high owing to a lack of competition in the international gateways (table 4.6). The cost of calling countries within Africa is lower in countries that are connected to submarine cable. Countries with competitive international gateways pay significantly less to call within Africa and to the United States than those with monopolistic international gateways. But price variations in competitive gateways are often defined by subtle details of the legal situation. Despite competitive gateways, in some ECOWAS countries, the price of the 20-hour connectivity to the Internet is not lower than in countries without competitive gateways. In Nigeria, for example, where Internet service providers can provide their own satellite connectivity, NITEL (the

incumbent) has had a monopoly over the landing station and has not offered cost-based wholesale rates to the ISPs to connect to SAT3. The high prices reflect the monopoly over the landing station. In contrast, Senegal which has a monopoly with a social orientation in the international gateway, has lower prices than Nigeria.

To attain connectivity between all capital cities in the the region, ECOWAS member countries will have to add 1905 kilometers of new fiber optic links. Achieving the minimum levels of regional connectivity will require investments in several countries. The levels of investment required in each case are very modest in absolute terms (table 4.7).

Table 4.6 Prices of Internet and phone calls in Sub-Saharan Africa, with and without access to submarine cables

	Price per minute for a call within Sub-Saharan (US$)	Price per minute for a call to United States (US$)	Price for 20 hours of dial-up Internet access per month ($)
No access to submarine cable	1.34	0.86	67.95
Access to submarine cable	0.57	0.48	47.28
Monopoly international gateway	0.7	0.72	37.36
Competitive international gateway	0.48	0.23	36.62

Source: AICD calculations

In addition to the cost of achieving intraregional connectivity, the ECOWAS region, combined with Central African countries, will have to spend $1 billion to install the Infinity, GLO-1, and WAFS systems needed to provide intercontinental connectivity (table 4.8). While this investment is larger than that required in any other regional community, the bulk of the investment relates to submarine cables and will be funded by the private sector.

Table 4.7 Gaps in intraregional connectivity and total investment required to attain minimum levels of regional connectivity

Country	Gaps(km)	Cost
Burkina Faso	218	6
Côte d'Ivoire	93	3
Ghana	210	6
Guinea	288	8
Guinea Bissau	113	3
Liberia	382	10
Niger	75	2
Nigeria	200	5
Sierra Leone	326	9
Total	1905	51

Source: Dervied from Mayer and others 2009.

The benefits of completing regional integration of ICT networks would be substantial in relation to the modest costs. Experience from other African countries, suggests that connecting a country to a submarine cable via a competitive arrangement for landing stations can bring down the costs of broadband Internet by as much as 75 percent (box 4.1). Not only would this bring substantial savings to existing users of broadband, but the substantial price reduction could be expected to induce additional uptake of service. The overall benefits of completing the regional integration agenda can be estimated to be $120 million per year for ECOWAS, compared with costs of only $51 million to complete the backbone connectivity. This investment leads to an attractive rate of return of 235 percent for the regional community as a whole (table 4.9). The bulk of the benefits derive from the addition of new broadband users, making regional integration a positive business prospect for broadband service providers.

A number of greenfield investments have been made to develop the communications backbone in several countries. A one-time investment in Senegal is resulting in a 34 percent rate of return annually. In several other countries such as Burkina Faso, Niger, and Nigeria, the greenfiled invesments that are in place have had an impressive rate of return. Yet when the gaps in the backbone and connectivity are bridged, the rate of return will escalate. For example, in Burkina Faso, a $6 million investment to address ICT gaps will lead to a 56 percent rate of return on this investment annually (table 4.9).

Table 4.8 Intercontinental and intraregional spending needs for ECOWAS for 10 years

	Intercontinental connectivity	
	Projects	Required annual investment (US$ millions)
East Africa	EASSy, TEAMS	260
Southern Africa	Infraco, SRII	510
Central Africa	Infinity, GLO-1, WAFS	1,010
West Africa		
Total, Sub-Saharan Africa		1,780

Source: Mayer and others 2009.

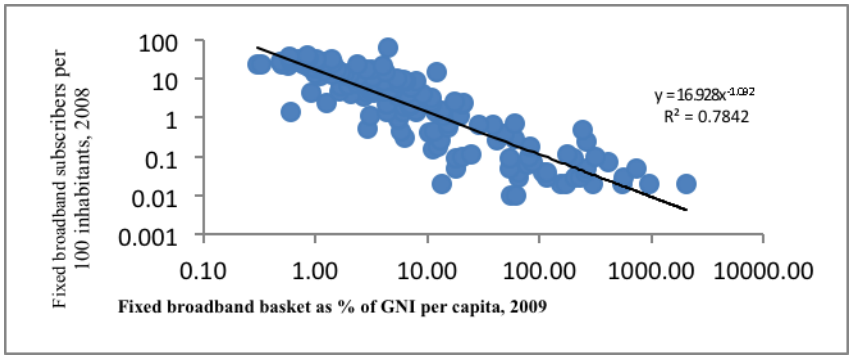
Table 4.9 Summary of cost-benefit analysis of regional integration

	Fixed broadband subscriptions '000s		Monthly benefit (US$ millions)		Investment need (US$ millions)		Rate of return (%)	
	Before	After	Before	After	Greenfield	Remaining gap	Greenfield	Remaining gap
Benin	2.7	7.4	0.12	0.10	2.0		134	
Burkina Faso	4.5	11.5	0.15	0.12	19.6	5.9	17	56
Cape Verde	7.4	8.3	0.10	0.01	0.0			
Côte d'Ivoire	10.0	74.8	0.17	0.54	27.1	2.5	31	337
Gambia	0.3	1.4	0.01	0.01	5.2		5	
Ghana	23.0	55.9	0.38	0.27	8.1	5.7	97	139
Guinea		…	0.00	0.00	7.7	7.8		
Guinea-Bissau	-	0.3	0.00	0.00	4.9	3.1		
Liberia	...	0.5	0.00	0.00	10.6	10.3		
Mali	5.3	20.4	0.11	0.16	26.3		12	
Niger	0.6	2.3	0.06	0.09	11.6	2.0	15	86
Nigeria	67.8	258.0	2.67	3.74	59.3	5.4	130	1,425
Senegal	47.4	49.2	0.71	0.01	25.6		34	
Sierra Leone		1.4	0.00	0.00	8.8	8.8		
Togo	1.9	1.8	0.13	0.00	4.4		36	

Box 4.1 Methodology for calculating benefits of ICT

Affordability significantly affects access to telecommunications services. As the price of broadband service rises, the number of fixed broadband subscribers per 100 inhabitants drops (see figure).

Relation between broadband penetration and broadband affordability, world



The cost of Internet access largely depends on the wholesale price paid for international Internet connectivity. Presently, African countries rely heavily on satellite connections for Internet access. But fiber optic cable can lower the cost of Internet access provided countries allow Internet service providers (ISPs) open access to the cable. For example, in Kenya, connectivity to the fiber optic cable produced a 75 percent drop in international bandwidth prices.

Assuming Kenya's wholesale cost reduction were applicable to other countries and that international wholesale prices account for half of the ISPs' cost structure, the reduction in retail prices is assumed to be 37.5 percent. The potential savings for consumers in African countries, once they have open access to undersea fiber optic networks, can then be estimated. The revised broadband tariff is used to estimate the number of new broadband subscriptions based on the equation shown in the figure. Based on these assumptions, it is estimated that a 37.5 percent reduction in retail broadband prices would result in a *consumer* savings of $159 million for existing subscribers. The lower broadband prices would trigger new subscriptions estimated at around 2.7 million (compared with 833,000 in 2008). These new subscriptions would generate an additional $800 million of new revenue.

Certain assumptions in the model should be noted. The model assumes a standard broadband tariff, even though there are a number of different packages depending on speed. It assumes a scenario similar to Kenya's in terms of the degree of the price reduction, and that half of the wholesale price reduction will be passed through to retail prices. It also assumes that there is a lone relationship between broadband pricing and take-up, even though other variables such as education and infrastructure availability will also have an impact. Finally, the model shows the one-off effect of a 37.5 percent reduction in retail tariffs. The timing of the full reduction is likely to spread over several years in some countries.

Source: AICD

5 Regional infrastructure funding

Completing and maintaining ECOWAS's regional infrastructure backbones would entail sustained annual spending of $1.5 billion dollars annually over the course of a decade. The preceding sections identified key gaps in ECOWAS's regional infrastructure backbone. A basic regional package that would complete the infrastructure required for full regional power trade, a complete regional road network, and fiber optic links connecting all countries to submarine cables would cost $1.6 billion annually if implemented over a decade. To put this in perspective, the total amount of annual infrastructure spending in the ECOWAS region to fulfill both regional and national infrastructure demands amounts to $27 billion. Hence, the regional portion accounts for only 6 percent of the overall requirement.

The amount of spending needed attain the basic levels of regional integration described in the preceding chapters varies hugely across countries and sectors (table 5.1). Looking across sectors, the largest spending requirements—in terms of investments, operations, and maintenance—are in power ($1 billion annually), followed by transport ($375 million), and information and communication technology (ICT, $8 million). Guinea and Nigeria have the highest spending needs in the region in absolute terms. Guinea would have to spend $919 annually, mainly on power, to meet the regional spending needs for infrastructure. Nigeria needs to spend $232 million on regional integration, largely related to road investments and maintenance.

Although the bulk of the regional infrastructure spending needs relate to new investment, there is also a significant ongoing need for maintenance spending. Maintaining ECOWAS's regional backbones, once completed, would cost a significant $458 million a year, most of it ($234 million) associated with maintenance of the regional road network.

The burden of regional spending as a percentage of GDP varies by country and is daunting in the case of some countries (figure 5.1). Guinea Bissau, Liberia, and Guinea have the highest burden, expressed as a percentage of gross domestic product (GDP). Guinea would have to spend almost 30 percent of its GDP to fulfill regional investment needs. Liberia and Guinea Bissau would have to spend more than 5 percent of GDP to fulfill regional spending needs. These levels of spending are far beyond what these small and fragile economies could reasonably sustain, making it unlikely that they would be able to deliver their portion of the regional backbone unless some kind of external funding were found.

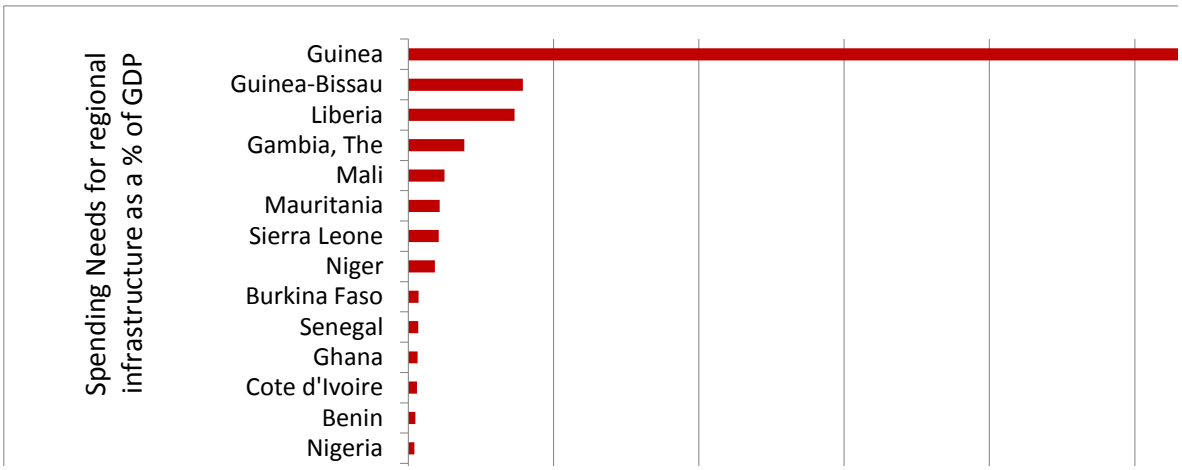
Table 5.1 Regional spending needs by sector

	Power		Transport		ICT		Total		
Country	Investment	O&M	Investment	O&M	Investment	O&M	Total investment	Total O&M	Total (inv+ O&M)
Benin			2	8			2	8	10
Burkina Faso			3	15	0.59	0.03	4	15	19
Cote d'Ivoire	27		3	18	0.25	0.01	31	18	48
Gambia, The		7	1	1			1	8	9
Ghana	5		9	20	0.31	0.02	14	20	34
Guinea	786	80	28	24	0.78	0.04	815	104	919
Guinea-Bissau	5		2	5	0.55	0.03	7	5	12
Liberia	2		10	6	1.03	0.05	13	6	19
Mali	26		24	16			50	16	66
Mauritania	1		14	5			15	5	20
Niger	1		9	18	2.36	0.12	12	18	30
Nigeria	2	137	21	72	0.24	0.01	23	209	232
Senegal	3		8	19			11	19	30
Sierra Leone			7	5	0.88	0.04	8	5	13
Togo			0	2			0	2	2
ECOWAS	**858**	**224**	**141**	**234**	**7**	**0.35**	**1,006**	**458**	**1,464**

Source: AICD calculations.

*empty cells indicate that AICD does not estimate any spending for investment or maintenance of a specific sector

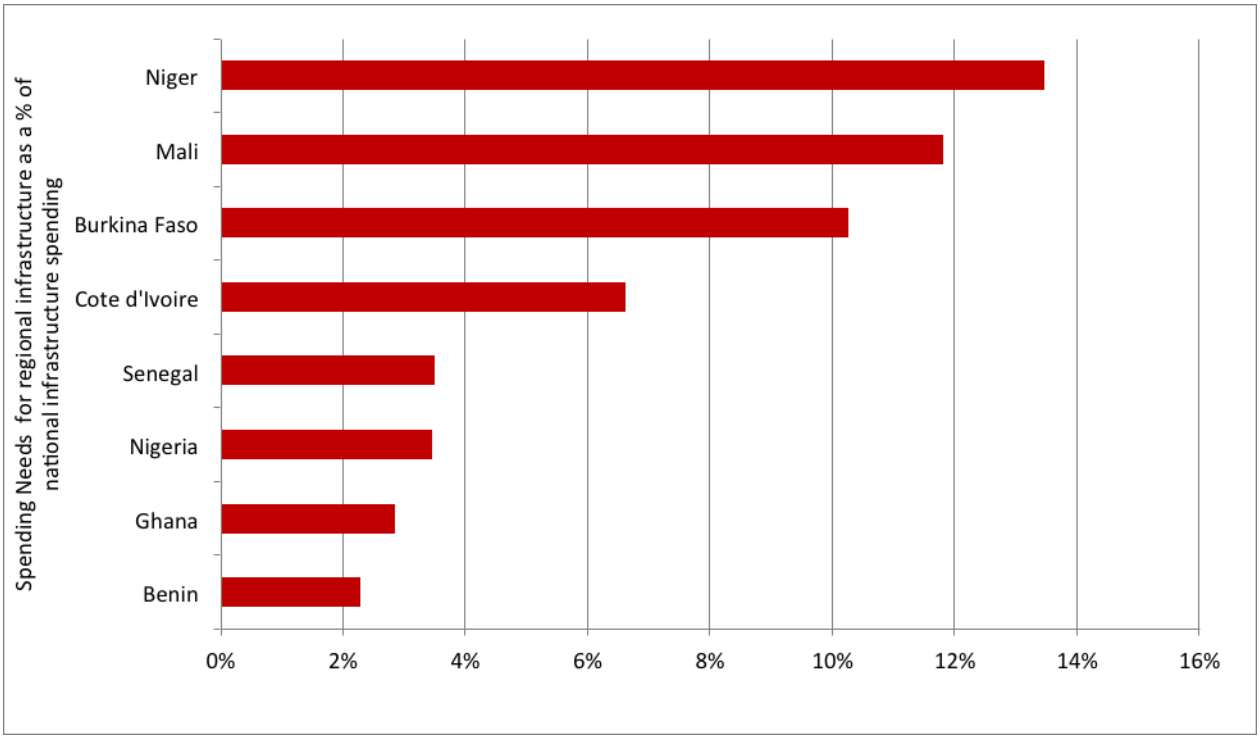
Figure 5.1 Spending for regional infrastructure as a share of GDP



Source: AICD calculations.

To meet regional requirements several countries would need to devote around 10 percent of their existing infrastructure budgets to regional projects. Figure 5.2 expresses each country's regional spending requirement as a percentage of existing infrastructure spending. Information on existing spending is available only for a subset of countries. This analysis identifies a first group of countries (Benin, Cote d 'Ivoire, Ghana, Senegal, and Nigeria) that could meet their regional spending quotas by allocating less than 10 percent of their existing infrastructure spending to regional projects. However, there is a second group (Mali, Burkina Faso, Niger) that would need to devote 10–15 percent of their infrastructure spending to regional projects in order to meet their share of regional spending needs, which looks to be a much tougher proposition.

Figure 5.2 Spending for regional infrastructure as a percentage of national infrastructure spending



Source: AICD calculations.

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This country report draws upon a wide range of papers, databases, models, and maps that were created as part of the Africa Infrastructure Country Diagnostic. All of these can be downloaded from the project website: www.infrastructureafrica.org. For papers go to the document page (http://www.infrastructureafrica.org/aicd/documents), for databases to the data page (http://www.infrastructureafrica.org/aicd/tools/data), for models go to the models page (http://www.infrastructureafrica.org/aicd/tools/models) and for maps to the map page (http://www.infrastructureafrica.org/aicd/tools/maps). The references for the papers that were used to compile this country report are provided in the table below.

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About AICD

This study is a product of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa. AICD provides a baseline against which future improvements in infrastructure services can be measured, making it possible to monitor the results achieved from donor support. It also offers a solid empirical foundation for prioritizing investments and designing policy reforms in Africa's infrastructure sectors.

The AICD is based on an unprecedented effort to collect detailed economic and technical data on African infrastructure. The project has produced a series of original reports on public expenditure, spending needs, and sector performance in each of the main infrastructure sectors, including energy, information and communication technologies, irrigation, transport, and water and sanitation. *Africa's Infrastructure—A Time for Transformation*, published by the World Bank and the Agence Française de Développement in November 2009, synthesized the most significant findings of those reports.

Reports on Africa's for major regional economic communities (RECs) provide a snapshot of the state of integration of infrastructure networks at the regional level. The focus of these reports is on benchmarking infrastructure performance within and between RECs, gauging the benefits of regional integration, identifying missing links, and quantifying the main financing gaps and their distribution across countries. These reports are particularly relevant to national and regional policy makers and development partners working on regional integration programs.

The AICD was commissioned by the Infrastructure Consortium for Africa following the 2005 G8 (Group of Eight) summit at Gleneagles, Scotland, which flagged the importance of scaling up donor finance for infrastructure in support of Africa's development.

The AICD's first phase focused on 24 countries that together account for 85 percent of the gross domestic product, population, and infrastructure aid flows of Sub-Saharan Africa. The countries are: Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Uganda, and Zambia. Under a second phase of the project, coverage was expanded to include as many as possible of the remaining African countries.

Consistent with the genesis of the project, the main focus is on the 48 countries south of the Sahara that face the most severe infrastructure challenges. Some components of the study also cover North African countries so as to provide a broader point of reference. Unless otherwise stated, therefore, the term "Africa" is used throughout this report as a shorthand for "Sub-Saharan Africa."

The World Bank has implemented the AICD with the guidance of a steering committee that represents the African Union, the New Partnership for Africa's Development (NEPAD), Africa's regional economic communities, the African Development Bank, the Development Bank of Southern Africa, and major infrastructure donors.

Financing for the AICD is provided by a multidonor trust fund to which the main contributors are the United Kingdom's Department for International Development, the Public Private Infrastructure Advisory Facility, Agence Française de Développement, the European Commission, and Germany's KfW Entwicklungsbank. The Sub-Saharan Africa Transport Policy Program and the Water and Sanitation Program provided technical support on data collection and analysis pertaining to their respective sectors. A group of distinguished peer reviewers from policy-making and academic circles in Africa and beyond reviewed all of the major outputs of the study to ensure the technical quality of the work.

The data underlying the AICD's reports, as well as the reports themselves, are available to the public through an interactive Web site, www.infrastructureafrica.org, that allows users to download customized data reports and perform various simulations. Many AICD outputs will appear in the World Bank's Policy Research Working Papers series.

Inquiries concerning the availability of data sets should be directed to the volume editors at the World Bank in Washington, DC.